1990

R&D OPERATIONAL PLANS

CONFIDENTIAL

Name A. C. Lilly

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1990 Major Programs

Program	Coordinator(s)	Director
Project ART	Alonso/Spielberg	Burnley/Myracle
Sigma/Beta	Gauvin/Whidby/Losee	Lilly
Domestic Product Support	Heretick	Myracle
International Product Support	Heretick	Myracle
Operations Support	Leyden	Kuhn
Filtration Research	Gauvin/Whidby	Myracle
Paper Technology/ Reduced Sidestream	Ferguson/Sanders	Charles/ Myracle
Project Tomorrow	Whidby	Charles
Optical Processing	Whidby	Charles
Low Tar/High Flavor	Spielberg	Myracle
TSNA	Ellis	Charles
LBA	Ellis	Charles
New Expansion Process	Craze	Burnley
Cast Sheet RCB	Alonso	Burnley
Project PACT	Hayward	Burnley
Project Ambrosia	Heretick	Myracle
Technology Assessment	LaRoy	Lilly

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: C. Ellis **Date:** October 1, 1990

From: G. N. Yatrakis

Subject: **ABSTRACT OF PROJECT ART PRESENTATION -- SEPTEMBER 18, 1990**

PROJECT ART

The Next products being test marketed in Tampa and the B&H De Nic products being test marketed in Phoenix were briefly reviewed.

ART II, the ART incremental change program, was described. The purpose of this program is to re-evaluate any previous work as well as investigate new ideas and concepts which will result in a directional improvement, although not significant, in the subjective character of ART products. The three main areas to be investigated are: processing, construction (with emphasis on filters), and flavors. This work is scheduled for completion during the first quarter of 1991.

The results of the second and third tar/nicotine interaction studies were presented. The test products and protocol for the fourth and fifth tests were also presented.

The Half-Nic program was discussed with emphasis on Blend Development. Tests are ongoing to determine if the currently produced Blend 215 extracted component is equivalent subjectively to the Blend 232 extracted component.

Work is on-going to increase the subjective response of Half-Nic products through the use of basic materials applied to the unextracted portion as well as through new filter technology.

cc: H. Spielberg
H. Alonso
C. Kroustalis
Central Files

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ABSTRACT

ART Process Development

Planning Meeting Presentation, September 18, 1990

The ART program has two objectives: 1) Continued development of the current stem absorber process to provide optimum product attributes for filler and stem, and 2) Development of a second generation supercritical CO2 extraction process using liquid column absorber technology. The first objective has been met with the exception of stem utilization from the current process. Other process development efforts under this objective are geared strictly to support the Bermuda Hundred factory operation, and Product Development.

Five strategies have been formulated to address the second objective. They are:

1. Optimize the batch liquid absorber process for extraction efficiency, best product subjective attributes, and minimum water requirements.

2. Define the configuration for a commercial liquid absorber vessel design.

3. Develop a disposal process for nicotine.

4. Develop technologies for separation and recovery of non-nicotine compounds from the liquid absorber medium.

5. Develop technologies to replace/substitute the non-nicotine compounds removed by the liquid absorber.

The current plan is to have a commercial liquid column absorber vessel designed by January of 1991. At that time, we will also have evaluated and selected a nicotine elimination process. This technology will be transferred to Engineering, and a 650 will be submitted in late 1991 for conversion of one loop at Bermuda Hundred to a prototype liquid column.

Work is currently in progress by the Chemical Research Division on a process to selectively separate the non-nicotine "flavor" compounds from the liquid column material, and re-apply them to the extracted cut filler. Flavor Development is currently evaluating the potential for this process. A pilot process will be installed at the Bermuda

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Hundred Pilot Plant for continued development, if the preliminary subjective evaluations are positive.

George Yatrakis reported on the subjective results for inclusion of ART stems in reconstituted products. To date, only inclusion of two percent ART stems in RCB has passed subjective testing. This usage level will support approximately 0.9 billion cigarette per year production by Bermuda Hundred. Combinations of ART stems in sheet products, such as five percent in RCB and two percent in RL, have not passed subjective tests. The current projection is that ART stems will be usable at no more than seven percent in RCB, which would support three billion cigarettes per year production. Attempts to improve the stem subjectives through various post-processing steps have not proved successful. Based on these results, a recommendation was made to continue work to qualify utilization of stems in the sheet products, but not to pursue development of a post-ART process to improve stem subjectives. Water column technology will be implemented to achieve production levels from Bermuda Hundred higher than what will be supported by acceptable levels of stem in the sheet products.

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

RECEIVED
MAR 22 1990
CLIFF LILLY

To: C. Ellis

Date: March 21, 1990

From: R. Prasad

Subject: PROJECT ART PROGRAM PLAN UPDATE

As per your request at the planning meeting, this is to confirm that there are no significant modifications/changes to the ART plan.

R Prasad

cc: H. Alonso
H. Burnley
C. Lilly
Central Files

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: C. Ellis

Date: February 15, 1990

From: R. Prasad

Subject: PROJECT ART - OPERATIONAL PLAN UPDATE

Attached is ART Program Plan 1990-93.

The current emphasis of the ART Program remains the development of second generation extraction processes, i.e., liquid absorber.

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ART PROGRAM

STATUS AND BACKGROUND

FEBRUARY 1990

During 1986 and 1987, laboratory trials at R&D and at Kaffee Hag in Germany demonstrated the feasibility of producing an acceptable cigarette from nicotine-reduced filler using supercritical CO_2 as the solvent and stems as the absorber.

Engineering work began in 1986 on the design and construction of a commercial facility capable of producing alkaloid-reduced filler to support a market of 12 billion cigarettes per year, and on the construction of the ART Pilot Plant for further process development work to support the commercial process.

The pilot plant came on-stream in August of 1987. The first series of pilot plant trials helped answer the engineering design questions for the commercial plant. The pilot plant's priorities were shifted toward supporting product development efforts to meet the program goals of 97 percent extraction and best subjectives.

The commercial plant was successfully started up in April and test market production was begun in May 1989. The plant operating conditions were significantly changed to reduced CO_2 pressure, reduced AB and citric acid on stems, resulting in improved product attributes. R&D support continues to be provided during the process optimization phase of the commercial plant operation. As part of the process optimization study, significant gains in plant capacity have been obtained at the new operating conditions.

For the remainder of the plan period (1989-1992), the process development activities will focus on the second generation extraction process, i.e., liquid absorber to replace the stem absorption system. Significant success in defining the design of the commercial liquid absorber system was achieved in the 1st quarter 1990.

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ART PROGRAM OBJECTIVES

1. Develop products with filler which has had its nicotine extracted with supercritical CO_2.

2. Develop commercial supercritical CO_2 processes to extract nicotine from filler.

3. Develop second generation supercritical processes utilizing liquid column absorber technology.

4. Assure the operational reliability and safety of the pilot plant.

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ART RESOURCE REQUIREMENTS
DIRECT ALLOCATION - FALL 1989
(1990 TO 1994 PROJECTIONS)

	1990	1991	1992	1993	1994
1. SUPPORT CURRENT PROCESS	30.85	23.75	20.15	12.75	12.60
2. DEVELOPMENT *Optimize Product/Process *Liquid Absorber *New Conditions	20.95	17.05	16.05	15.35	14.95
TOTAL	51.8	40.8	36.2	28.1	27.6

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OBJECTIVE	STRATEGY	TACTIC	TIME
1. Product Development Develop products with subjective character equal to or better than price/ value brands, such as Doral, from filler which has had its nicotine extracted with supercritical CO_2.	1.1 Determine optimum blend to meet the extraction goal under commercially feasible process conditions, and best subjective character.	1.1.1 Evaluate impact of process parameters on product quality (i.e., stem type, process parameters, pH, stem inclusion, pre- and post-ART processing).	Ongoing
	1.2 Develop cigarette models to accomplish combination of nicotine-in-smoke deliveries and best subjective character.	1.2.1 Develop cigarette models using ART filler in "novel" construction, i.e., low density rod, different papers and various filters, i.e., charcoal, paper, poly propylene, etc.	4th QTR 1989 (Complete)
		1.2.2 Develop cigarette models to test the subjective character with a range of tar delivery at various levels of nicotine delivery.	Ongoing
	1.3 Explore alternate applications of supercritical fluid technology, to provide significant improvement in subjectives and/or new product introduction.	1.3.1 Provide subjective and analytical support.	Ongoing
		1.3.2 Evaluate individual blend components for subjectives. Select a new blend to respond to test market results and/or marketing requirements.	4th QTR 1989 (Complete)

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2. <u>Process Development</u> Develop commercial supercritical CO_2 process to remove 97% of the extractable nicotine from filler.	2.1 Determine best processing conditions for selected blend, to meet desired product attributes.		Complete
	2.2 Optimize commercial process to achieve the design operating capacity.	2.2.1 Support commercial plant tests to optimize extraction variables in order to meet design capacities. a. Tobacco packing density measurements. b. Tobacco and stem OV. c. Stem CPI. d. Theoretical correlations and testing vis a vis Dr. Zenz. e. Fixed and expanded bed tests with grid. f. University of Texas visual testing.	4th QTR 1989 (Complete)

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	2.2.2 Support the commercial plant in implementing technology to achieve 12 billion cigarettes per year capacity.	2nd QTR 1990
	a. Define fill/extract/vent cycle.	
	b. Automate cycle on one loop.	
	c. Convert all loops.	
2.3 Optimize current process.	2.3.1 Evaluate extraction process changes to improve product attributes:	
	a. Alternate acids.	3rd QTR 1989 (Complete)
	b. Lower absorber temperatures, with new heat exchanger.	1st QTR 1990
2.4 Develop analytical methodology to define completion of extraction cycle.	2.4.1 Support installation/ evaluation of CD monitor in the commercial plant, as needed.	1st QTR 1990
2.5 Assure the pilot plant capability to simulate commercial process.	2.5.1 Apply predictive model to pilot plant via selected parametric study. Develop it to support commercial plant.	2nd QTR 1990

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2.6 Complete the development of pre- and post-ART tobacco processes.	2.6.1 Support the commercial plant operation via refining current processing.	
	a. Hauni steam tunnel operation.	4th QTR 1989 (Complete)
	2.6.2 Develop alternate pre- and post-ART processes for process/product improvement.	
	a. Application of alternate strip and filler casing, i.e., NH_4OH, glycosylamine, $Ca(OH)_2$, etc.	2nd QTR 1990
	2.6.3 Complete microbial investigation of ART filler.	4th QTR 1989 (Complete)
	2.6.4 Continue support of pilot plant via production of alternate filler blends/ casings, as needed.	Ongoing
2.7 Complete development of pre- and post-ART stem process.	2.7.1 Evaluate alternates for utilization of stems.	2nd QTR 1990
	a. RCB/5% stems (CA double batch).	
	b. RLTC/2% stems (CA double batch).	
	c. Richmond panel recommendation.	
	2.7.2 Implement utilization of Bermuda stems in sheet material.	3rd QTR 1990

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		2.7.3 Evaluate stem post-treatment techniques to significantly increase the ART stem utilization levels, i.e., chemical/physical modifications to improve subjectives.	Ongoing
3. Develop a second generation supercritical extraction process for tobacco, using liquid column absorber technology.	3.1 Optimize extraction-liquid-absorption process.	3.1.1 Operate lab facility in coordination with Hoboken and University of Texas, to firm up design.	4th QTR 1989 (Complete)
		3.1.2 Evaluate subjective quality using batch liquid absorber.	1st QTR 1990 (Complete)
		3.1.3 Develop a computer model of liquid absorber leading to process optimization.	1st QTR 1990
		3.1.4 Minimize extraction of non-nicotine solubles, i.e., countercurrent staging, minimum liquid amount.	1st QTR 1990
		3.1.5 Explore use of flavors in liquid "in-feed" to minimize loss of flavors, i.e., spike liquid with tobacco flavors from another source.	2nd QTR 1990

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3.2 Define configuration of commercial design.	3.2.1 Define best liquid absorber configuration for commercial design. a. Plexiglass model for efficient liquid-liquid contact. b. Use of sieve tray/packing. c. Liquid absorber pH, concentration. d. Liquid absorber stage efficiency, number of stages. e. Liquid absorber temperature and design for water balance.	2nd QTR 1990
3.3 Develop a disposal technique for nicotine in absorber effluent stream.	3.3.1 Evaluate nicotine disposal options, i.e., chemical, carbon, conventional waste treatment.	1st QTR 1990
	3.3.2 Demonstrate technical feasibility of selected option for nicotine disposal on pilot plant scale.	2nd QTR 1990
	3.3.3 Recommend commercial design.	3rd QTR 1990.
3.4 Develop technology for the separation-recycle of flavors in the liquid absorber.	3.4.1 Explore separation technology for the selective removal of flavors from nicotine.	2nd QTR 1990

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		3.4.2 Demonstrate feasibility of selected separation technology on laboratory scale.	3rd QTR 1990
		3.4.3 Test scale-up of "feasible" separation technology, including evaluation of subjectives on pilot plant scale.	4th QTR 1990
		3.4.4 Recommend commercial application of best separation process.	1st QTR 1991
	3.5 Develop a continuous tobacco extraction process.	3.5.1 Demonstrate early feasibility on laboratory scale.	2nd QTR 1991
		3.5.2 Design and construct a continuous pilot plant for process development.	4th QTR 1992
		3.5.3 Evaluate process/product attributes of a continuous design.	4th QTR 1993
4. Assure the operational reliability and safety of the pilot plant.	4.1 Maintain operational/design integrity of the pilot plant.	4.1.1 Carry out periodic safety inspections of the equipment.	Monthly
		4.1.2 Inspect the system for safety, i.e., corrosion, weld x-ray, hydrotesting, ultrasonics, etc.	Ongoing
		4.1.3 Maintain operating personnel training and emergency protocols/readiness.	Ongoing

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4.1.4	Assure that any changes/ additions at the pilot plant are in-line with the original design specifications.	Ongoing

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

RECEIVED

Richmond, Virginia

CLIFF LILLY

To: Dr. Cathy Ellis

Date: February 28, 1990

From: H. L. Spielberg

Subject: 1990 Operational Plans - Project ART

Attached are the Project ART 1990 Operational Plans.

If I can be of further assistance in this matter, please feel free to contact me.

H. L. Spielberg

HLS:lgk

Attachment

cc: R. Heretick
C. Lilly
J. Myracle
J. Spruill
G. Yatrakis

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3) "New" Taste: ART non-menthol cigarettes are considerably different subjectively from any conventional cigarette that is currently available. To capitalize on these differences, we are pursuing two unique taste directions.

Timetable

POL 2 candidates — Results 2nd Qtr., 1990

C. Strategy III - Determine the optimum nicotine delivery at a given tar level which offers the most acceptable subjective presentation.

Initial work indicates that at a given tar level, there is a cutoff point for nicotine delivery above which subjective acceptance increases dramatically. To determine this cutoff point at various tar levels, a matrix of cigarettes will be produced, analyzed and subjectively evaluated. Tar levels will vary from 3 to 16 mg and nicotine-in-smoke from 0.2 mg to 1.0 plus mg.

Timetable:

Produce cigarettes	1st Qtr., 1990
Complete subjective evaluation	2nd Qtr., 1990

D. Strategy IV - Support of Liquid-Column Absorber Development.

Provide subjective and analytical evaluations, cigarette designs, coordination of prototype production and product development activities.

Timetable — Ongoing

E. Strategy V - Support of Low Tar/High Flavor program.

Provide all necessary support for the "Best of the Lowest" and "B&H 1/2 nic" programs.

Timetable — Ongoing

F. Strategy VI - To evaluate and develop process modifications for the utilization of ART process by-product tobaccos.

Development of process modifications for post-ART stems to use directly in blends as ES and IS has been suspended due to use of coarser cut at Bermuda Hundred. Testing in sheet materials involves substitutions for stems in RCB and RL's to determine acceptable levels. Tests in progress are designed to qualify use of 2% MPC stems in production RCB which would deplete the inventory in 13 months. Emphasis on testing citric acid stems has been shifted to comparisons to qualify single and double-batched stems from Bermuda Hundred. Initial evaluations are being made of 2% levels in Pilot RL and 5% levels in Production RCB.

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ART PROGRAM
1990 OPERATIONAL PLAN
February 28, 1990

I. **Objective**: Develop a family of subjectively acceptable low and ultra-low tar, regular and menthol products from filler which has had approximately 97% of its nicotine extracted with supercritical CO_2.

II. **Strategies**:

A. Strategy I - Determine optimum blend and process conditions to meet the extraction goal under commercially feasible conditions with the best subjective character.

1) Blend 215 with the new low pressure processing conditions appears to offer the best subjective character to date. Future work will concentrate on evaluating the subjective effects of varying certain processing parameters in the commercial facility. These include, but are not limited to, CO_2 flow rates, double and triple batching of stem in the absorber, low OV extraction, reducing/eliminating PG, evaluating alternate pre-extraction bases and additional pre- and post-extraction processing parameters.

Timetable — Ongoing

B. Strategy II - Development of casing, aftercut and menthol systems which compliment the subjective attributes of de-nicotinized filler.

1) Menthol: Due to the trigeminal effect of menthol, the absence of nicotine in the mentholated product is not as apparent, subjectively, as in the non-menthol. To assure that we are targeting for the most subjectively acceptable level of menthol, various menthol-in-smoke targets are being evaluated by the menthol monadic panel in both 85 and 100 mm constructions.

Timetable:

Complete all POL testing — 2nd Qtr., 1990

2) Casing/Flavor: A series of 3 novel casing systems with 7 different aftercuts each have been made and are under intense subjective evaluation. Development work will continue to produce a casing and aftercut system which compliments the effects of de-nicotinized filler and is subjectively preferred over the original test market product and the new blend/process prototype.

Timetable — Ongoing

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Tests of Production RL's and RCB combinations are planned for Second Quarter of 1990.

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Abstract
Quarterly Planning Meeting

"Domestic Product Support"
by C. B. Altizer

The following projects were reviewed in the area of domestic product line extensions and product maintenance: Parliament Menthol, Bucks, B&H King Size, Marlboro Ultra Lights, Marlboro Menthol 83mm FTB, Marlboro 83mm FTB, Cambridge Ultra Lights, and Alpine 83mm FTB. The objectives, status and timetables for each project were reviewed.

With regard to "New Product Introduction Plan", the development status of the projects and the progression through the timetable for each project indicates that objectives are being met in a timely manner.

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. A. C. Lilly **Date:** March 27, 1990

From: R. P. Heretick

Subject: **1ST QUARTER UPDATES, 1990 OPERATIONAL PLANS**

At the 1st Quarterly 1990 R&D Planning Meeting the following major programs were presented:

- Domestic Product Support
- International Product Support
- Project Ambrosia

Each of these programs followed the documents supplied for the 1990 Operational Plans. Additional information was made available for the Planning Meeting which included market place updates and test market updates where appropriate for the individual development projects.

A specific exception was reported, however, in that our anticipated sales volume for Japan in 1990 will be 32 billion.

R. P. Heretick

RPH:da

cc: C. L. Ellis
J. L. Myracle

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. A. C. Lilly Date: February 15, 1990

From: R. P. Heretick

Subject: DOMESTIC PRODUCT SUPPORT

Objective: Develop new cigarette products and/or modify existing products to meet current market opportunities, to open new market segments and to maintain quality products in the market place. The overall objective is to increase our market share.

Strategies:

I. Free Standing Brands

Develop conventional and unique free-standing products to compete in current environments or create new segments.

- Project Natural I

  Develop cigarette products with acceptable subjective response without the enhancement of casing and flavors.

  Complete 1st Quarter

- Project Natural II

  Develop cigarette products with acceptable subjective response which incorporate 10 or less casing and flavor ingredients.

  Complete 3rd Quarter

- Project Natural III

  Develop cigarette products with acceptable subjective response which incorporate only natural casing and flavor ingredients.

  Complete 3rd Quarter

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II. Brand Extensions

Continue to develop line extensions that will offer consumers a greater choice and enhance brand share.

- Parliament Menthol

  Develop menthol products which will extend the Parliament franchise into the menthol category.

  Complete 2nd Quarter

- Bristol, Cambridge and Alpine

  Prepare prototypes and specifications for these products which will extend each franchise into the full range of conventional packings and configurations.

  Complete 2nd Quarter

III. Brand Repositioning

Redevelop or modify selected brands for repositioning to enhance consumer benefits and maximize share potential.

- Cambridge Blend Developments

  Evaluate new tobacco blends and non-tobacco materials which will yield new product specifications for a more cost effective product in this value category.

  2nd Quarter

- Marlboro Program

  Develop an 83mm Box format for the Marlboro Brand family.

  2nd Quarter

- Marlboro Medium

  Develop on 83mm Box format with a tar delivery higher than Marlboro Lights but less than Marlboro Full Flavor.

  2nd Quarter

Resource Allocations

The current and projected resource allocation is shown below.

Project Leader	1.5
Product Development Engineer	3.0

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Other Resources Required -

Semiworks
CTSD
PED
Cigarette Technology
Flavor Development
Leaf Blending
Manufacturing/Operations Support
Engineering

Technology Transfer

Products which are developed in the programs listed here as well as new programs defined during the year incorporate new technology developed in R&D major programs (such as Filtration Research, Low Tar High Flavor, and Paper Technology). These technologies are evaluated and utilized where the subjective performance of the product is enhanced.

R. P. Heretick

RPH:da

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International Product Development
Affiliates & Licensees

Abstract of September, 1990
R&D Planning Meeting Presentation

The presentation included three major areas: Volume/Income Summary, Selected TV/Cinema Advertising, and Project Summary.

The Volume/Income Summary detailed 1990 (projected) results by region, with the conclusion that on sales of about 258 billion units, PM International will generate approximately US $1.2 billion operating income.

In the Selected TV/Cinema Advertising portion of the presentation, a video was shown. The video contained cinema advertising from Germany and TV advertising from Philippines and Argentina.

Six of the active projects (33 total) were reviewed in the Project Summary: Zolder, New Leaf, Lory, EEMA BBS, Amethist, and SPEC. Objectives and timetables were discussed.

Alan H. Confer
10/03/90

2021553959

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. A. C. Lilly

Date: March 27, 1990

From: R. P. Heretick

Subject: 1ST QUARTER UPDATES, 1990 OPERATIONAL PLANS

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R. P. Heretick

RPH:da

cc: C. L. Ellis
J. L. Myracle

2021553960

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PHILIP MORRIS PRODUCTS, INC.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. A. C. Lilly Date: February 6, 1990

From: A. H. Confer

Subject: INTERNATIONAL PRODUCT SUPPORT - 1990 OPERATIONAL PLANS

1. Objective

The objective of International Product Support is to contribute to the growth of PM's international cigarette business.

2. Strategies

Three strategies are employed to achieve the objective:

a. Product Maintenance/Improvement
b. Reactive Product Development
c. Proactive Product Development

3. Tactics/Timetables

The tactics supporting the three strategies are the individual projects. Summaries of the projects (with timetables) for Asia/Pacific and Latin America are shown in the Attachments. At this moment, these projects represent the 1990 agenda for International Product Support. Of course, it must be recognized that projects are added and completed/deleted on a continuing basis.

4. Resource Allocation

The current and projected resource allocation is shown below.

Project Leader Asia/Pacific, EEC/EEMA, and Special Projects	1
Assoc. Sr. Prod. Dev. Eng.	1
Prod. Dev. Eng.	3
Assoc. Prod. Dev. Eng. B	1
Project Leader, Latin America/Iberia	1
Prod. Dev. Eng.	3

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5. Technology Transfer

It is anticipated that any technology transferred in 1990 will be incorporated in export cigarettes.

Alan H. Confer

AHC:da

cc: Mr. R. P. Heretick

2021533962

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ATTACHMENT 1

ASIA/PACIFIC PROJECTS

A. Korea

1. **Seoul Consumer Panel**
   Tests 4 and 5 will be shipped 1st Qtr. Both tests will include Project Ring prototypes.

2. **Virginia Slims Superslims**
   A factory trial will be conducted 1st Qtr.

3. **Project Target**
   PMI testing of selected prototype(s) will be initiated 1st Qtr.

B. Taiwan

1. **Taipei Consumer Panel**
   Results from Test 3 are expected 1st Qtr.

C. Hong Kong

1. **Project Cedar**
   Revised prototype(s) will be evaluated and recommended for PMI testing 1st Qtr.

2. **PM Super Lights**
   Selected prototype(s) will be recommended for PMI testing 1st Qtr.

D. Philippines

1. **Project Lory**
   L&M prototype(s) will be produced at La Suerte 1st Qtr.

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ATTACHMENT 2

LATIN AMERICA/IBERIA PROJECTS

A. Venezuela

1. **Project Blanco II**
   A reduced delivery product will be consumer tested 1st Qtr.

2. **Project Pino**
   Consumer testing of Parliament will begin 1st Qtr.

3. **Marlboro Improvement**
   Subjective/analytical evaluations of prototypes will be done 1st Qtr.

B. Guatemala

1. Reposition Derby Menthol as a competitor to Casino Menthol.

2. Develop a free-standing menthol brand competitive with Casino Menthol.
   AC flavor will be evaluated on Blends P1 and P2 1st Qtr.

3. Develop Derby Suaves to compete with Casino.

4. Develop a free-standing LTN brand competitive with Casino.
   Prototype NB-109-P1 has been selected for AC flavor work.
   Guatemala will send prototypes with 20-25% ventilation.

C. Costa Rica

1. **Hilton Improvement**
   New A/C to be evaluated 1st Qtr.

2. **Derby Improvement**
   Improvement noted with Derby A/C on Hilton cut rag.

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PHILIP MORRIS PRODUCTS, INC.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. A. C. Lilly Date: February 14, 1990

From: J. N. Smith

Subject: JAPAN PRODUCT DEVELOPMENT - 1990 OPERATIONAL PLANS

Objective: To develop new cigarette products for the Japanese market which will contribute to our growth in this marketplace.

Strategies:

1. Develop new cigarette products that meet PMKK's planned product introductions. The 1990 planned introductions are as follows:

   - o Lark Milds KS Box (5-Pack Carton) 2/90
   - o Merit Lights Menthol KS Box 5/90
   - o Va. Slims Lights Menthol 100's SP 6/90
   - o Chesterfield KS Box 8/90
   - o Battistoni KS Box 3 Qtr., 1990

2. Develop new cigarette products to anticipate Japan's consumer trends and/or provide a marketing advantage. The 1990 priorities are as follows:

   - o Nippon Art
   - o Low Sidestream
   - o Menthol
   - o Alternative Filter Configurations
     - Concentric
     - Fluted
   - o Superslims
   - o Ultra Low Tar

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3. Maintain and/or enhance the subjective, analytical and physical performance of existing products in the Japanese marketplace. The 1990 priorities are as follows:

- Lark
  - Tar Level
  - Blend
  - Filter
- Marlboro/Marlboro Lights
  - Tar Level
  - Blend
- Carbon
  - Activity Level
  - Particle Size
  - Impregnation
- Filters
  - Replacement of Black Tow
  - Carbon on Paper/CA Web

4. Continue to improve our understanding of the Japanese market through the following:

- Interpretation of market sales data and demographics.
- Continue to conduct an annual switching study.
- Increase our knowledge of the types of blends, flavors, filter systems and delivery levels acceptable to the Japanese consumer.
- Interface with PMKK Marketing and Sales personnel, import agents, haiso and retailers.

Resource Allocations

The current and projected resource allocation is shown below.

Japan Product Development

Project Leader	1
Product Development Engineer	2

Outside Resources Required

Semiworks
CTSD
PED
Cigarette Technology
Flavor Development
Leaf
Manufacturing/Operations Support
Engineering
PMKK Marketing and Sales

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Technology Transfer

Transfer product specifications for product modifications on Japan Marlboro KS SP and Box, Marlboro 100's SP and Marlboro Lights KS SP and Box to Japan Tobacco in February, 1990.

J. N. Smith

JNS:da

cc: R. P. Heretick
S. B. Nelson

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. C. Ellis Date: September 24, 1990

From: R. Ferguson

Subject: Operations Support Presentation - 3rd Quarter
R&D Planning Conference - September 17, 1990

P. Grantham presented details on the materials evaluation program. R. Ferguson presented an overview of the remainder of the Operations Support activities. In the area of quality assurance support, several ongoing activities were reviewed.

The analytical flavor specifications effort continued to enlarge the number of specifications issued and vendors contacted. The certification of export flavors will be transferred to the Flavor Center during October.

The export sheet certification project has progressed to the point of evaluating samples from export batches of RL and RCB. Certification will begin before the end of the year, in preparation to transferring responsibility to QA.

The monogram ink project has been finished with respect to R&D involvement with the development of new ink formulations. There have not been significant new developments with respect to customer complaints or analytical support for QA.

Several projects were discussed in the area of recon facility support. The alternate humectant program requires the preparation of additional quantities of PG/G free DIET and ESB. There was also discussion of the evaporator upgrade and dry flavor replacement projects in support of Park 500. Another, completed project, Warhol, was mentioned. FTR staff have prepared a report which just issued and which makes recommendations with respect to Europe and USA expansion feedstocks and conditions.

A large number of production support activities were also reviewed. A number of groups are providing information for a tobacco storage study, including mold evaluation on 1989 Bright crop tobaccos. Other engineering studies discussed included methoprene application at LPF, the burley drier replacement study at MC, and the Octagonal burley spray cylinder at Stockton Street.

The Marlboro Standardization run VIII in progress the week of September 17 was described. Flavor development activities in the area of flavor analytical support, tobacco materials support, the natural glycerine subjective study and support to factories for new and test brands was detailed.

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The discussion of packaging evaluation was abbreviated due to the comprehensive presentation made earlier by Mr. Latshaw.

The tobacco microbiology project activities were discussed mainly with respect to important ongoing research on nicotine bioconversion being conducted by the group.

A new program area, adhesives, was also presented. Several incidents in the past year have provided evidence that PM needs to take care of compositional issues instead of relying on what vendors sell us. Mr. Daylor is arranging disclosure agreements with all appropriate adhesive vendors.

The entomology program was only reviewed briefly since its activities had also been mentioned several times in earlier discussions. Several projects in the area of environmental compliance were also mentioned. Research is providing an increasing level of resources to various areas of environmental issues.

There was a brief concluding section on some specific contributions from CTSD and Semiworks. Each of these divisions is supplying resources to support a number of important, ongoing operations support activities.

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: R. N. Ferguson **Date:** September 28, 1990

From: P. F. Grantham

Subject: Abstract from Quarterly Planning Meeting Presentation of Materials Evaluation

The Materials Evaluation System is a program whose primary responsibility is to evaluate indirect materials (machine parts, conveyor belts, cleaning supplies, etc.) that are proposed for use in manufacturing/processing areas. It is a cooperative effort between all locations and departments within PM USA. Administration of the program is provided by QA, specifically QE, while analysis of samples and recommendations on product use are provided by R&D. An assessment of this program was recently completed in which several issues were identified that would enhance and improve the system, and recommendations made to address those issues. The issues that were identified fell into two groups. The first being those which the committee itself could address, and secondly those for which management approval and/or input was needed.

The issues which the committee itself will address are as follows:

- Expand the scope of annual facility audits; this includes meeting with purchasing to review factory purchases, and to conduct a more indepth audit versus policing poor housekeeping.
- Follow-up audits; this will be six weeks after the audit to monitor the corrective actions taken.
- Expand the facility committee representatives responsibilities; have them conduct quarterly audits of their own facility.
- Increase the involvement of the R&D Toxicologist; this has already been implemented.
- Increase frequency of the committee meetings; this would allow for more interaction and discussion between facilities to aid in problem solving.
- Timely replacement of "N" recommended items; items which were not recommended, but were allowed to be used (e.g. OEM machine parts) will be reviewed every six months to monitor activity on seeking replacements.
- Audit material usage utilizing Purchasing/Inventory database; identify high use items for reevaluation to monitor possible material changes from vendors.
- Develop a prioritized list for sample testing; identify areas with highest probability for contributing to foreign matter in product.
- Upgrade the system database; allow for free-form data entry, remote site access for users and interaction with other databases.
- Continue to increase the awareness of the program by conducting presentations.

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The following issues required management input:

- The inclusion of TTG into the program; TTG currently submits samples but have no guidelines to follow regarding needed information, also no traceable historical information is stored for these samples.
- Timely replacement of "X" recommended materials; the implementation of identified, acceptable replacement materials for those not recommended has been lacking.
- Development of a PM USA group to investigate replacement materials

All of these issues have been presented to management. In the case of TTG, Mr. Campbell has appointed someone to the committee. Regarding the replacement of "X" materials, Mr. Darrah has made his General Managers aware and requested information on those items in use in their facilities. Mr. Taylor has appointed someone to invetigate replacement materials.

The responsibility of scheduling and development of a timeframe for implementation of the recommendations, as well as development of the priority sampling list rests with QA.

cc: D. Leyden
Central Files

2021553972

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

File

PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. C. Ellis Date: March 28, 1990

From: R. N. Ferguson

Subject: Operations Support - 1st Quarter 1990 Update

The individuals responsible for various portions of the Operations Support program have supplied me with the attached updates, which reflect changes in program emphasis and manpower allocations for the first quarter of 1990.

There were no significant changes made to areas of the plan which originated from comments made at the recent planning conference.

Attachments

cc: W. F. Kuhn

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

RECEIVED
MAR 9 1990
R. N. FERGUSON

To: Dr. R. Ferguson Date: March 7, 1990

From: W. R. Raymond

Subject: Operations Support, Flavor Development -- 1990 Strategic Plan

Per your request, I have modified 1990 Flavor Development Division Operations Support Program projections, sent to Chris Kroustalis on February 6, to include brief status descriptions. Resource allocation estimates are also included. If you have any questions, please feel free to call me.

OPERATIONS SUPPORT

Flavor Analytical Support:

Objective: To provide analytical and troubleshooting support to Operations Services, Quality Assurance and Manufacturing in matters involving flavors or flavor-related problems.

Status: From 1/1/90 through 2/28/90, 77 samples have been analyzed, including ingredients, flavors, casings, and consumer complaints.

Operational Plans: Analytical support and troubleshooting will continue as appropriate upon request. Support areas include out-of-spec. concentrates, preblends and finished flavors and casings, off-flavors or odors, foreign matter, ingredient problems, etc.

Primary Contact: R. Hale, OC/T3W, Ex-3642.

Nontobacco Materials Support:

Objective: To provide analytical and subjective evaluation support for the characterization and qualification of packaging materials, nontobacco cigarette components and other factory materials.

Status: Subjective evaluations have been completed on a series of blank and tipping adhesives for the Manufacturing Center. Foreign matter was confirmed analytically in a sample of PZ from Stockton Street.

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Operational Plans: Subjective panel evaluations will continue as appropriate upon request by Operations Services to qualify and/or characterize any new factory materials such as filters, papers, inks, adhesives, packaging materials, cleaners, etc. to ensure product subjective integrity. Headspace GC evaluation of packaging materials will continue as required for established and new brands.

Primary Contacts: Subjective Requests -- W. Bell, OC/T3W, Ex-4299,
Analytical Requests -- R. Hale, OC/T3W, Ex-3642.

Natural Glycerin/Triacetin:

Objective: To develop analytical and subjective criteria necessary to qualify and specify all-natural glycerin-based triacetins from multiple vendors for interchangeable use as filter plasticizers.

Status: Subjective assessments are nearing completion to confirm the natural:synthetic glycerin ratio used in the manufacture of Eastman Estrobond B. Data are under evaluation. Subjective evaluation continued on natural and synthetic triacetins from different vendors. This work is ongoing.

Operational Plans: Eastman will convert this year from bulk glycerin feeding system to a constant metering system ensuring a constant natural:synthetic glycerin feed ratio as determined by Flavor Development subjective results. Analytical and subjective characterizations of synthetic and natural glycerins and triacetins from various vendors will continue in an effort to identify and classify impurities with respect to subjective quality. Direction will be provided to glycerin and triacetin vendors as appropriate to try to standardize both glycerin and triacetin to the highest possible subjective quality standards for interchangeable use in Manufacturing.

Primary Contact: R. Hale, OC/T3W, Ex-3642.

Flavor Revisions:

Objective: To subjectively evaluate revised ingredients and/or flavors to qualify same for use in Manufacturing.

Status: Twenty revised ingredients and flavors were subjectively evaluated for qualification during the first two months of 1990.

Operational Plans: Revision ingredients and flavors and Flavor Center submissions from Operations Services will continue to be evaluated and recommended for approval or further assessment.

Primary Contact: B. Taylor, OC/T3W, Ex-4288.

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Factory Subjective Support:

Objective: To provide subjective panel testing services to Manufacturing to monitor new brand and test market start-ups, to troubleshoot subjective problems in filler and cigarettes and to qualify process and direct material changes.

Status: Subjective monitoring is in progress of primary expansion process variables and the B&H Menthol brand startup, both at Cabarrus. Merit Lights Menthol (Japan) production also is being subjectively monitored from Stockton Street and the Manufacturing Center.

Operational Plans: Subjective monitoring and troubleshooting activities will continue on an as-needed basis. Subjective testing for qualification of the MC Bulk-Handling process for reconstituted and Oriental tobaccos is expected to continue throughout the first half of 1990.

Primary Contact: W. Bell, OC/T3W, Ex-4299.

Marlboro Standardization:

Objective: To aid in the standardization of manufacturing processes and procedures among PM factories to ensure consistant quality and minimal variation in the Marlboro brand family.

Status: Marlboro Standard VII results have been reported to all factories, Semiworks, Flavor Center, and Operations Services. Subjective evaluations of Marlboro KS and LS cigarettes from a January 3, 1990, factory pickup are in progress. A factory pickup of Marlboro Lights from all factories was requested on March 6, 1990. These cigarettes have been received and will be subjectively evaluated when CI results are available.

Operational Plans: Current 1990 projections include three unscheduled factory pickups each of Marlboro and Marlboro Lights (all packings) which will be subjectively evaluated by the Marlboro Standard Panel. In addition, a standard run (VIII) is tentatively scheduled for August, 1990, in which all manufacturing locations (including Semi-works) will produce Marlboro and Marlboro Lights using the common flavor lots and, where applicable, the same cigarette and packaging materials. Cigarettes from Standard Run VIII will be subjectively tested both internally (Marlboro Standard Panel) and externally (POL). Selected analyses will be performed of ingredients, concentrates, preblends, finished flavors, blend components, finished filler and cigarettes to track production variation. The tentative schedule for Standard Run VIII is based on completion of the blend changeover to 1988 crop blend components.

Primary Contact: K. Deane, OC/T3W, Ex-4293.

PROJECT TOMORROW

Objective: Develop improved Marlboro candidates utilizing materials, designs, and technologies currently under development.

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Status: Subjective evalation of prototypes utilizing new materials, designs and technologies ongoing.

Operational Plans: When desired analytical targets are achieved, creative flavor development activities will begin to achieve subjective parity with Marlboro.

Primary Contacts: J. Shelton, OC/T3W, Ex-3135,
H. Maxwell, OC/T3W, Ex-2858.

PROJECT NATURAL

Objective: To develop 85mm and 100mm full-flavored and lights prototypes using blend components and flavor systems which will result in a natural blended product.

Status: Final specifications for nonadditive cigarettes (4, 8, and 12mg prototypes) are in preparation. Additional cased and flavored 8mg prototypes using Natural Blend G have been produced for analytical and subjective evaluation.

Operational Plans: Nonadditive prototype POL tests 0256 (8mg), 0257 (12mg) and 0258 (4mg) are scheduled for shipment on 4/3/90, 6/11/90 and 7/9/90, respectively. Casing and flavor development will continue on Natural Blend G prototypes.

Primary Contact: W. Bell, OC/T3W, Ex-4299.

OPTIMIZED DIET & RECON PROCESSES

Objective: To develop, evaluate, and/or optimize new additives, specifications and process changes to assure the subjective quality of reconstituted sheet materials.

Status: Internal panel tests have shown parity for control versus upgraded evaporator RL's from Park 500. Similarly, Park 500 RL's with dry flavor replacement have shown parity with control sheet by internal testing. POL tests have been requested for the above test sheets. Further physical and subjective tests of alternate humectants are planned prior to POL testing.

Operational Plans: Subjective evaluations will continue on RL's made on Park 500 Line 3 to qualify the evaporator upgrade on that line. Qualification testing will continue for dry flavor replacement in RLB and for a range of sheet solubles in each RL. Internal subjective testing for the evaporator upgrade and dry flavor replacement is projected for completion during the first quarter. Efforts will continue to qualify an additional vendor source for roasted St. John's Bread native extract. Subjective support will continue for various processing plant tests, including additive levels and feedstock changes. R&D support projected to

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continue throughout 1990 includes subjective evaluation of alternate humectants, preservatives and processing aids such as Yankee release agents.

Primary Contact: J. Swain, OC/T3W, Ex-5476.

ART SUPPORT

Objective: To provide subjective, analytical and process support as required to Bermuda Hundred Facility and factories for test market and brand production.

Status: Subjective support to Bermuda Hundred has continued to monitor extraction and primary modifications. On-site assistance has been rendered to BH in optimizing pre- and post-extraction casing applications, cased filler hold time studies, and conversion to double batch stems. Flavor, casing and process specifications have been transmitted for BH primary and factory cigarette production for Ad-Pack testing.

Operational Plans: On-site assistance, analytical and subjective monitoring activities for Bermuda Hundred and factories will continue as required. Factory support and analytical/subjective monitoring are planned for upcoming Ad-Pack and all Test Market productions. Continued subjective and analytical assistance will be provided to BH for anticipated process changes. Packaging material subjective effects will be monitored as necessary.

Primary Contacts: G. Yatrakis, OC/T3W, Ex-4289,
J. Swain, OC/T3W, Ex-5476.

ENVIRONMENTAL ISSUES (GRAIN)

Objective: To significantly reduce alcohol levels in PM flavor systems, and consequently factory environmental emissions, while maintaining product subjective integrity.

Status: MC Panel results showed no subjective differences between control Cabarrus Cambridge and test with 30% alcohol reduction in the aftercut. Trials in Semiworks have been completed to establish procedures prior to scale-up for POL production trials.

Operational Plans: Work will continue with Cambridge aftercut to reduce ethanol by 30% via preparation by a sonolation process. Analyses of flavors on filler and cigarettes, and subjective evaluations will continue. Alternative methods to sonolation will be investigated. POL testing of reduced-ethanol versus current flavor systems, for Cambridge and other brands as applicable, is planned to test for subjective parity.

Primary Contact: S. Ruziak, OC/T3W, Ex-2079.

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RESOURCE ALLOCATIONS

Operations Support	2.40 Man-years
Project Tomorrow	0.20 Man-years
Project Natural	0.30 Man-years
Optimized DIET/Recon	0.50 Man-years
ART Support	2.25 Man-years
Environmental Issues	0.25 Man-years
TOTAL	5.90 Man-years

W. R. Raymond

cc: J. Myracle
H. Spielberg

2021553979

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. R. Ferguson Date: March 16, 1990

From: Roger T. Bass

Subject: Cooperative Agricultural Programs With PM Leaf Department

I am providing the following information as you requested. As the PM representative on the Flue-Cured and Burley Tobacco Cooperative Variety Evaluation Committee Programs it has been my function to carry out and to coordinate the tasks of these programs in conjunction with PM Leaf Department personnel. Various other types of agricultural research tests concerned with agronomic production practices have also been included in the scope of these activities. These test programs are a cooperative effort of the U.S. tobacco industry with all facets of the industry participating and being represented. The goal of this effort is to maintain, improve and assure that the U.S. grown tobacco used in our products meets specific standards with respect to high quality characteristics. These quality characteristics include agronomic factors, chemical content, physical appearance, and acceptable smoke flavor. The potential new tobacco variety candidates must be tested for a minimum of two years at eleven research station locations for the Regional Small Plot Test and at twenty six farm locations for The Regional Farm Test. If an entry meets all minimum standards, it is then eligible for release as a new variety for grower planting. These tests are conducted each crop year in the major tobacco producing states. Since this program began about twenty five years ago, several hundred entries have been tested. As an example, during the 1989 crop tests a total of 2426 leaf tobacco samples were evaluated for physical characteristics in conjunction with PM Leaf Department personnel. In essence, this cooperative, industry wide program provides us with the necessary tool for the quality control of our most important raw material, leaf tobacco. The continuation of this program will support our efforts to maintain the highest possible level of excellence and quality in our products.

/ds

cc: G. Bokelman
J. Charles
H. Grubbs

Roger T. Bass

2021553980

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PROJECT WARHOL

1st Quarter, 1990, Planning Meeting

Objective: To support PM Europe R&D in conducting studies to compare the effects of differences in tobacco blends and process conditions on expanded product physical properties. The test plan includes testing the USA DIET blend and the European DIET blend in the MC, at MC tower conditions, and then running both blends in the Berlin DIET plant at both USA and Berlin process conditions.

Status and Plans:

The USA portion of the test plan was completed the week of February 12, 1990. The Berlin portion of the plan was carried out the week of March 11, 1990.

CV, sieve, and cigarette analytical results will be compiled for the two test series by mid-April. A report will be issued by PM Europe R&D, after joint review of the data by PM USA and Europe.

Resource Requirements:

Tobacco Materials Division: 0.1 persons

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RECEIVED
MAR 13 1990
R. N. FERGUSON

QUARTERLY PLANNING MEETING MARCH 1990

TOBACCO PROCESS & FABRICATION DEPARTMENTAL SUPPORT

OBJECTIVE: Provide cigarette manufacturing and primary processing capability and expertise to support product/process development activities for domestic and international operations. The plant and personnel produce cigarette models, aid in the development and testing of experimental equipment, evaluate new flavor/blend formulations, and do process development work.

Status and Plans:

1) Support for product development project

   a) 83mm flip top box development

      Status: HL packer rebuilt and installed. First large test to be run week of March 5.

   b) Mini tow plugmaker upgraded toward manufacturings standards.

      Status: Reinstalled and running.

   c) Combiner with 10/12 plug configuration upgraded toward manufacturing standards.

      Status: Reinstalled and running.

   d) Combiner with 18/9 plug configuration upgraded toward manufacturing specifications.

      Status: To be returned week of March 26.

   e) Provide large scale/small scale primary/make-pack and shipping services available as needed for:

      - New cigarette designs
      - POL, HTI, International Panels
      - Marlboro Standardization
      - TLA - Tobacco Lot Analysis

      Status: Continue support as needed.

2) Process development support for manufacturing operations.

   a) Octagonal (pinless) cylinder.

      Status: Prototype developed and tested. New design is being used in burley casing cylinder.

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b) Art processing development.

Status: Supporting development of new processing requirements.

3) Support consumer testing (mailout) programs.

a) Continue to assemble and ship as needed.

Status: Continuing

b) Initiated an IE study to evaluate improved operating techniques.

Status: Report to be issued 2nd quarter.

c) Optical Detection of Ringtipping defects.

Status: P.M. Engineering has completed design. Testing should be completed 1st quarter.

4) Flavor Development Programs Support

a) Support blending design changes, sheet product development, applied flavor development, and specialty cigarette/filler designs.

Status: Continuing

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CIGARETTE TESTING SERVICES

First Quarter, 1990 Planning Meeting

I. ANNUAL INVESTIGATION OF RECONSTITUTED TOBACCO

Objective: Investigate each major manufacturer's reconstituted tobacco annually. Prepare written report.

Status: The reconstituted tobacco from Philip Morris and competitor's brands, manufactured during third quarter, 1989, were microscopically examined for material content and type of process. Brown & Williamson was the only manufacturer that made a change in their reconstituted tobacco since these materials were examined in 1988. Brown & Williamson uses three types of reconstituted tobacco. Two are made by the papermaking process and the third is a "RCB" sheet. This "RCB type" sheet material is mixed in a 50/50 ratio with the "RL type" sheet in only Viceroy 85 and 100 cigarettse. The "RCB type" sheet contains diamonium phosphate (DAP) as indicated by the level of soluable ammonia (0.69%) and phosphorus (2.10%). High total alkaloids content (3.09%) may be indicative of a high burley stem content.

Plans: To continue to investigate each major manufacturer's reconstituted tobacco for 1990.

II. MARLBORO STANDARDIZATION

Objective: Analytical evaluations of production Marlboro KS/LS.

Status: A pickup of Marlboro cigarettes was conducted on January 3, 1990 for analytical evaluations.

Plans: Continue to pickup for analytical evaluation on a quarterly basis.

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

III. CIGARETTE INFORMATION

Objective: To examine competitive cigarettes on a regular basis to determine changes in the physical and cigarette smoke characteristics of these brands.

Status: Report was published January 30, 1990.

Plan: Domestic competitive brands are received monthly from ten U.S. cities. All brands are tested monthly for FTC tar and nicotine deliveries, carbon monoxide, total and filter RTD, ventilation, total alkaloids and total reducing sugars. Mentholated brands are tested each month for menthol in the smoke, filler and filter. Once each quarter, in addition to the analyses listed above, the following tests are performed on the brands: filtration efficiency, filler rod TPM, static burning time, cigarette length, circumference, paper component, permeability, filter length, filter weight, tobacco weight and rod density. Levels of reconstituted material, expanded tobacco and expanded stems are determined semiannually. The following testing regimen is followed for these extensive quarterly analyses: 85 mm plain cigarettes are tested in January, April, July and October; 100 mm plain cigarettes are tested in February, May, August and November, all mentholated samples are tested in March, June, September and December.

In addition, salesmen samples, i.e. those cigarettes that the competition may be launching in test markets, are forwarded for a complete analysis to investigate properties of this proposed new cigarette.

JEW:rad

cc: Mr. W. F. Kuhn

2021553985

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

PACKAGING SOLVENTS SUPPORT

Objective:

Provide support to QA and Purchasing relative to the analysis of residual printing solvents in packaging.

Status and Plans

Currently, we are providing quantitative and qualitative data to Purchasing on samples from new, printed and unprinted packaging and inks. This information is used by Purchasing to evaluate new packaging concepts and vendors to determine if levels of residual solvents meet the specifications for PM printed materials used for packaging cigarettes. Additionally, we support the QA analytical effort in this area by providing standards, identification of unknown solvents in packaging used routinely in Manufacturing, and troubleshooting of analytical problems.

We plan to continue to support this program at the same level in the future.

2021553988

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: .R. N. Ferguson Date: March 7, 1990

From: .D. L. Faustini

Subject: .Operations Support Update - First Quarter, 1990 - Project 1101

Objective: Provide entomology support in a timely manner to PM USA. Perform research on cigarette beetle (CB) control. Serve as the experts within the Company to provide assistance in controlling the CB and other injurious pests at all locations.

Status and Plans

1. Research Studies

a. Methoprene: Evaluate 1-10 ppm methoprene on scrap and stem during 24 months lab storage; conduct bioassays; analyze data - 10/89-2/90.

Status: Continuing

b. KABAT® (Maury St. Whse.): Investigate potential CB resistance and non-uniformity of KABAT® application; initiate bioassays; 10/89-2/90.

Status: Continuing

c. KABAT® Fate: Determine fate of methoprene during tobacco processing, primary processing, ES, IS, ET and reordering cylinders; 11/89-2/90.

Status: Continuing

2. Support Projects

a. Infestation Control Manual: Provide a comprehensive standardized pest control manual to support PM International to address CB control - initial distribution 12/89-2/90.

Status: Continuing

b. Customer Complaints: Continue to monitor insect infestations of finished product as related to customer complaints and determine means of prevention.

Status: Continuing

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c. Assistance:

1. Continue to interact with QA, E&EP and Leaf Departments at PM domestic operating companies as needed.

2. Continue to provide technical support to PM operating companies on an as-needed basis.

Technical Transfer: KABAT® - Evaluate the transfer and implementation of the KABAT® treatment to 100% domestic tobaccos. Groups to be affected will include Leaf Dept., Quality Assurance, and Universal Leaf Tobacco Co.

Status: Preparation is underway to begin transfer to processing facilities.

Resources: Projected 4.0 persons for 1990. Also requires resources: 0.25 persons from Analytical to conduct periodic methoprene residue analyses.

d. Export Cut Filler: Negate methyl bromide by substituting probe-equipped vacuum-steam conditioning to obtain phytosanitary certificates for export cut filler; interact with APHIS (Animal Plant Health Inspection Service) personnel to obtain the necessary compliance agreement for this alternative treatment method; issue a recommendation; coordinate implementation; 10/89-2/90.

/mps

cc: C. K. Ellis
R. W. McCuen

2021553980

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. R. Ferguson Date: March 7, 1990

From: R. McCuen

Subject: **Operations Support Update - First Quarter, 1990**

TOBACCO MICROBIOLOGY

Objective: to enumerate and otherwise evaluate the microflora resident in tobacco materials in support of Operations

Status:

These studies, which arise as responses to requests from various sources in Operations, are conducted so as to measure the populations of bacteria, yeast and mold in tobacco and related materials. Prominent among them is the need to determine the effects of storage over time on microbial populations to identify conditions that might permit microbial growth, leading to chemical changes that affect subjectives. Studies conducted during 1989, and those presently in action, are listed below with requestors identified. (Completed studies are identified with an asterisk.)

Storage Studies

A. Hogshead/Box/Bale Storage Study (F. Jones)

Over three-year periods, monitor the microbial populations of bright and burley strip stored in hogsheads, boxes or bales. The major finding has been that both tobaccos stored in boxes tend to manifest mold growth more than those stored in hogsheads or bales, but bacterial and yeast growth is minor. Ongoing study.

B. "Famous" Blend Storage Study (L. Jennings)

The microbial populations of a modified Chesterfield blend for export ("Famous") were monitored at monthly intervals during six months of storage under jungle, desert and ambient conditions. Jungle storage was terminated at eight weeks owing to excessive mold growth, but storage under desert and ambient conditions produced no notable population changes. Assays of chemical constituents are incomplete at this writing.

C.* Bulk Tobacco Handling Storage Study ("Rolling Silo") (R. Bowman)

RLB, RLTC, RCB and MT held in a mobile silo at various OV values and time periods (up to 72 hr) were monitored for population changes. Such storage was uneventful, with populations similar to those found in materials stored in hogsheads.

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D.* Post-ART Process Filler Storage Study (J. Baggett, B. Taylor)

ART filler, held at 35°C/80% RH and at 25°C/60% RH for periods up to 12 weeks, manifested no significant changes in bacterial or mold populations. A similar result was obtained using ART filler (stored for up to 7 days in the cold) at 35% and 12% OV. Both sets of ART fillers contained elevated yeast populations at time zero, but this has not been observed in subsequent ART studies.

E.* ART Cigarette Storage Study (R. Carchman, W. Hempfling)

Cigarettes containing cased and uncased ART tobacco, and unextracted tobacco, were stored in open trays under desert and jungle conditions for periods of up to eight weeks. ART-extracted and unextracted cigarettes were stored in separate jungle rooms to avoid nicotine transfer. No notable changes of bacterial or yeast populations occurred. Some excitement arose due to extensive growth of mold on the ends of the ART models by six weeks, but subsequent work showed that airborne fungal contamination was the likely cause of that bloom. Subsequently, placing unextracted cigarettes in the contaminated jungle room also resulted in mold growth on the cigarette ends.

F.* Burley (20% Casing) Storage Study (M. Tallman)

Burley tobacco cased at a 20% level contained unchanged populations of bacteria, yeast and mold after storage at room temperature for 48 hr.

G.* Pre-DIET Process Storage Study (K. Houghton)

Bright strip (18% OV) and cut bright filler (22% OV) prepared for DIET processing was stored in PM-80 boxes for up to 7 days. Mold populations were slightly increased by Day 4, but bacterial populations did not change over the entire period.

H. Alternate Humectant Storage Study (R. McCuen)

Control (PEG+G) and test (Isosweet) sheets of RL150B, RLTC and RCB contained similar microbial populations at time zero. This is an ongoing warehouse storage study.

I. PM-80 Box/Liner Storage Study (focus on mold) (F. Jones)

Bright and burley strip, stored in PM-80 boxes for up to three years, will be monitored to determine if two different kinds of box liners result in different rates of mold growth. Time-zero samples of bright contained mold and yeast populations above specifications, but burley contained lower populations. This is an ongoing storage study.

J. Ivory Coast-Senegal Blend Storage Study (B. Semp)

Microbial populations of a tobacco blend intended for the Ivory Coast and Senegal were measured. Similar measurements will be performed on samples of that material by FTR when the tobacco has reached its destination.

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K.* Foam-Bonded Ends Solution Storage Study (S. Wrenn)

The susceptibility to microbial growth of an aqueous solution containing sodium carboxymethylcellulose and licorice (used for foam-bonding cigarette ends) was determined at room temperature and in the cold. After one day at room temperature increased yeast populations were detected, while storage in the cold prevented such growth. A recommendation was made to store the solution in the cold.

Other Studies

L. Dry Flavor Study (K. Houghton)

Multiple collections of dry flavor components and mixes have been made at the Manufacturing Center, Park 500, Twentieth Street and Stockton Street facilities. Populations of bacteria, yeast and mold were measured in each component and mix. From all facilities, neither bacteria, yeast nor mold were detected in Shiloh, Police, Candy, Candy M-40, or Petreo. DAP and urea from P-500 were also free of detectable microorganisms. Cochise consistently contained about 10^5 bacteria and 10^4 mold per g, while Jono contained about 10^4 bacteria per g, but was practically free of mold. When properly sampled, burley spray was free of bacteria or mold. At P 500, Cochise/urea contained about 10^3 bacteria per g and Jono/DAP contained about 10^2 bacteria per g. This was true even after 36 hr following formulation. Information about mold in those mixes is incomplete, as is all information about Dry Export Mix from the Twentieth Street facility. This study is to end in January 1990.

M.* Centrifuge Sludge Study (T. Bullock)

Because the re-addition of centrifuge sludge to the RL sheet at Park 500 is under consideration, the microbial populations of sludge from each centrifuge (Line 3) were measured. Only typical tobacco bacteria (bacilli) were found (about 10^8 per g dry weight), and the bulk of them were present as endospores. Preparation of heat-dried pellets from that sludge contained only about 1% of the original bacterial populations in fresh sludge. Neither mold nor yeast was detected in centrifuge sludge.

N.* SEL Nebulization Study (T. Bullock)

Aerosols produced by nebulization from SEL containing bacteria contained less than 10% of the starting population density in the SEL. A quantity of SEL was rendered sterile by sequential membrane filtration and supplied to Dr. R. Carchman for further studies.

O.* ART Water Scrubber Liquor Study (D. Howe)

Water scrubber liquor from the ART Pilot Plant was examined for bacteria, yeast and mold and was found to be free of microorganisms.

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P. **Nicotine Degradation in P500 Waste-Water Treatment (WT) System**
(C. Ellis)

Objective: to investigate nicotine degradation in samples from WT system (primary and aeration basins only) for estimation of nicotine-removal capability, and for potential linkage to RT (water column) process.

Status:

The project was initiated 9 January 1990. The levels of nicotine in waste water entering and exiting the primary basin (PB) are 30 - 40 ppm, but nicotine is not detectable in the aeration basin (AB). Rates of removal of added nicotine in PB water are slow, but AB water eliminates nicotine at about 45 ppm per hr (72°F). The site of major nicotine elimination is hence the aeration basin. A method for detection and enumeration of nicotine-metabolizing bacteria has been developed (at least eight different types of such bacteria are present).

Plans:

1. Continue on-going storage studies (A., H. and I., above).

2. Complete "Famous" study and Dry Flavor study (B. and J., above).

3. In study "P" the following will be done:

   a. Measure instantaneous rates of nicotine degradation in samples from aeration basins as a function of temperature (complete January 1990).

   b. Measure and identify populations of bacteria active in nicotine dissimilation (complete March 1990).

   c. Identify conditions (laboratory) necessary for complete removal of nicotine from ART water column effluent, using starting cultures from WT system (complete April 1990).

   d. Identify intermediate and end products of nicotine degradation (complete June 1990).

4. Continue to respond to requests for studies in support of Operations.

ALTERNATE PRESERVATIVES PROGRAM

Objective: to identify tobacco-identical or otherwise "natural" compounds to replace or supplement propylparaben (PPB) so as to minimize or eliminate microbial activity in changing chemical composition of SEL during processing.

Status:

To date (January 1990), of some 102 compounds tested, 12 compounds other than PPB have been identified as preventing growth of bacilli at

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levels of 250 ppm or less (Phase I agar-inclusion and shake-flask assays). Five of these compounds were effective in preventing growth in SEL (laboratory scale), but two of these were subjectively unacceptable (decanoic acid and β-cyclocitrylidene acetic acid); citronellol, carvacrol and thymol have not been subjectively tested. Seven compounds have not been tested in SEL (trans-cinnamaldehyde, nonanoic acid, undecylenic acid, lauric acid, decanol, dodecanol and σ-dodecalactone).

Plans:

Work was suspended pending completion of study of nicotine degradation in P500 waste-water treatment system. Resume in 2Q 1990, with recommendations for testing at P500 available 4Q 1990 (preservatives selected that are both efficacious at low levels and subjectively acceptable).

ALTERNATE HUMECTANT PROGRAM

Objective: to produce an acceptable full-flavored cigarette which is PG/G-free.

Status:

1. All control and PG/G-free feedstocks (prepared in the production facilities - RL, RCB, ET and ES), containing various amounts of Isosweet with K-pp where appropriate, were analyzed again after storage for subjective, microbiology and chemical composition. Results showed that all feedstocks were equivocal to the controls except in the amount of PG/G and sugars (as expected).

2. Time zero survivabilities for the RL and RCB sheets were completed in a satisfactory manner.

3. Nine different PG/G-free flavor and casing models have been made by Flavor Development personnel. The only model to give reasonable subjectives was one in which the PG/G was replaced with Isosweet.

4. Three small-scale Isosweet models (with 100%, 85% and 50% of the PG/G replaced with the sugars) and a control were made by the Flavor Development Division personnel. All three of the test cigarettes were not "in spec" as far as the analyticals were concerned and they were not subjectively acceptable.

5. A large-scale making run was conducted in mid-October in which the PG/G was replaced with Isosweet on a 1:1 weight basis. Two kinds of test cigarettes were made (0 and 10% dilution) and suitable controls. Survivabilities were done across the maker as well as cigarette analyticals and physicals. All test cigarettes were judged not different from the controls except in the analyticals (where expected) AND in subjectives.

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Plans:

Continue to develop PG/G-free casings and flavors for use on small-scale produced cigarettes until subjective parity is obtained with a suitable control. Produce large-scale cigarettes based on the above model and determine survivabilities in the Primary and Make-Pack areas of the Semi-works. If the subjectives of these cigarettes are equivalent to the control, 2-POLs will be initiated about mid-year to qualify these materials.

/mps

cc: Dr. C. Ellis

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MATERIALS EVALUATION

Objective: Examine materials proposed for use in all PM USA facilities and render judgement as to their acceptability for proposed use. Each material that is proposed for use in our Manufacturing facilities is submitted for analysis to the Materials Evaluation Committee. Based upon the outcome of the analysis and the intended use of the material, the material is judged to be acceptable for use (general), acceptable for the intended use only, not recommended for use, not recommended - use until a replacement is found, or acceptable for use in non-tobacco areas only.

Status and Plans

1. Materials are being analyzed as they are submitted and recommendations as to their acceptability are made - continuing.

2. Presentations: Twenty-three presentations were made to Engineering Department personnel in Richmond, Cabarrus, Louisville, and at York Engineering. These presentations detailing the program were made at the request of Engineering.

3. Audit Program: A joint decision was made between R&D and QA that audit samples will be analyzed by QA. If descrepancies or new products are found, those samples will be analyzed by R&D. To date, no audit samples have been pulled, however data from purchasing on items received continues to be supplied to us on a monthly basis.

4. Materials that have received "not recommended - use until a replacement is found" rating are being reviewed to determine if alternate materials have been found or are being sought. Inquiries on materials carrying this rating are made every 6 months. Ratings are changed to "not recommended" when acceptable replacements have been found.

5. Assisting QA in the analysis and identification of foreign material submitted from our facilities and offering recommendations on disposition - continuing.

6. Tours are being made of all PM USA facilities to identify materials that have not been evaluated and improper use of materials - continuing.

7. Interaction with Dr. Joseph Magill of the Materials Science Dept. at the University of Pittsburg, as a consultant to aid our major vendors (i.e. Hauni, Molins, etc.) in finding acceptable replacement materials for those not recommended is on-going. Dr. Magill has been sent pieces of polyurethane roller covers, along with drawings to begin his investigation into finding a acceptable replacement material. Dr. Magill's investigations continue.

8. Submissions from Packaging Development and TTG have increased. The largest increase has been from Packaging development regarding

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new ink, adhesive, and lacquer formulations. TTG samples have thus far been mostly adhesive samples, although some polymers have also been received.

9. The 1989 compilation of the Materials Evaluation Manuual, or "Redbook" was sent out to appropriate PM personnel in February.

Recources: Currently 2.5 persons and to remain at this level in 1989.

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ENVIRONMENTAL TOBACCO SMOKE
PROJECT 6502

Objectives: Install a 6-m^3 environmental chamber in room B-314 for use in ETS studies. Evaluate instrumentation and methods used to monitor ETS and develop new methods and new instrumentation. Maintain the readiness of equipment and personnel for off-site monitoring of ETS.

Status: The Chamber was installed the second week of January and was tested for its limiting relative humidity ranges. At 20 C° the chamber was able to maintain a relative humidity of 10%. Sample ports for the continuous monitoring of NO, NO_2, CO, CO_2, and particulates were installed. The chamber was used to study the effects of temperature and relative humidity on the RJR PASS cases. Both were found to affect the electrochemical CO sensors in the cases. Six PASS cases are currently operational and available for immediate use if necessary. In addition, two sets of individual monitors (particulates, CO_2, IR CO, temperature, %RH) are also available.

Plans: The continuous gas monitors attached to the chamber will be interfaced to a data acquisition system. Comparisons between IR-based CO monitors and electrochemical CO monitors will be made. A study of the Neotronics CO sensors used in the PASS cases, contracted with Dr. F. M. Hawkridge of VCU, has been completed. A final report is expected by the end of March. The precision, accuracy, and collection efficiency of acid-treated silica gel collection tubes will be studied. These tubes are used to collect airborne ammonia at levels present in ETS.

RESOURCES: 3.0 persons, broken down as follows:

0.5 person	interface continuous monitors to chamber
0.8 person	Compare IR CO versus EC. CO monitors
1.5 person	Ammonia in ETS by Silica gel collection
0.2 person	Administer and conclude contract with VCU.

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Operations Support Summary For Project 1708

Personnel: Dennis Driscoll and Pat Henderson in collaboration with the Applied Technology Group.

CHARACTERIZATION OF MONOGRAM INKS

I Objective: Develop incoming materials specifications for monogram inks.

Status and Plans: Press parameters are presently being measured on makers. These, in conjunction with previously elucidated operating windows, will be used to define monogram ink specifications to be used by our purchasing department.

II Objective: Develop new monogram inks that have shorter setting times for use on higher speed cigarette makers.

Status and Plans: ongoing

ENVIRONMENTAL COMPLIANCE

I Objective: Assess and develop ultrasonic dispersion technology for the removal of phosphorous from the effluent at the Park 500 waste treatment plant.

Status and Plans: Laboratory studies have been completed. Tests are planned at the Park 500 waste treatment facility.

II Objective: Develop and implement at plant levels low capital cost and low energy equipment to assure the required levels of dissolved oxygen (4.6 mg/L) in the effluent from the Park 500 waste treatment facility.

Status and Plans: Bench scale laboratory studies using intermixers have been completed. Tests at the plant level are ongoing.

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: C. Kroustalis Date: 7 March 1990

From: M. Zimmermann

Subject: Project 1757 - Operations Support - Projections for 1990

FLAVOR SPECIFICATIONS

Objective: To develop analytical and sensory specifications for incoming flavors and materials for use at the Flavor Center and other QA facilities. The secondary objective is to provide analytical certification on PMI export flavors manufactured at the Flavor Center and other locations for FRG compliance to the German Food Ordinance.

Operational Plans: Specifications for the incoming materials are operating in a vendor-by-vendor approach with three vendors' products currently on hand. The 'Dry Flavors' are also now on hand for the specifications process. These samples cover the variety of materials which are purchased - essential oils, botanicals, aroma chemicals, compound flavors and Liggett materials. There are approximately 385 different flavor materials. The materials on hand represent 119 of the total. Flavor Center personnel have been trained to use the methodology and are currently analyzing some of the incoming materials using these specifications. In order for specifications to become a part of the operation of the Flavor Center for incoming materials these specifications must be agreed upon with each vendor and entered by E. Cook's group into the IBM System 36 computer.

Certification of the export flavor materials is now in the second phase of the program. Currently, there are a total of 21 flavor codes produced for Germany. All of these materials have been analyzed for compliance to the German Food Ordinance one time. This also includes the analysis for heavy metals and pesticides for each code. Only seven of these PMI flavor samples need certification for the second time. However, a new request for the analysis of Marlboro specific flavor materials will require that four of these codes be certified four times per year instead of the normal two. In addition, 128 direct materials will also require certification, as well as, specification. This responsibility and the procedures used will be transferred to Flavor Center personnel following the completion of the approved expansion of the Flavor Center. R. Spencer is currently on-loan from the Flavor Center to learn the procedures and equipment used in this program. This work will continue until the completion of the 650 expansion of the Flavor Center.

Resources: The group is composed of three members from the Analytical Research Division and two members on-loan from QA. 4.5 Man-years.

Primary Contact Person: M. Zimmermann, C-201, Ex-5449.

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Mr. W. F. Kuhn Date: February 22, 1990

From: J. E. Wickham

Subject: Operations Support - Projections for 1990

Objective: To examine competitive cigarettes on a regular basis to determine changes in the physical and cigarette smoke characteristics of these brands.

Operational Plan: Domestic competitive brands are received monthly from ten U.S. cities. All brands are tested monthly for FTC tar and nicotine deliveries, carbon monoxide, total and filter RTD, ventilation, total alkaloids and total reducing sugars. Mentholated brands are tested each month for menthol in the smoke, filler and filter. Once each quarter, in addition to the analyses listed above, the following tests are performed on the brands: filtration efficiency, filler rod TPM, static burning time, cigarette length, circumference, paper component, permeability, filter length, filter weight, tobacco weight and rod density. Levels of reconstituted material, expanded tobacco and expanded stems are determined semiannually. The following testing regimen is followed for these extensive quarterly analyses: 85 mm plain cigarettes are tested in January, April, July and October; 100 mm plain cigarettes are tested in February, May, August and November, all mentholated samples are tested in March, June, September and December.

In addition, salesmen samples, i.e. those cigarettes that the competition may be launching in test markets, are forwarded for a complete analysis to investigate properties of this proposed new cigarette.

Resources in Man Years: 6.5

Primary Contact Person: J. E. Wickham (Ext. 2436) or Barbara Mait (Ext. 5224) - Operations Center/T2W

JEW:rad

cc: Dr. B. Ferguson
Dr. C. Lilly
Ms. B. Mait

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INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

W. F. KUHN

To: Dr. A. C. Lilly, Jr. Date: February 15, 1990

From: C. S. Kroustalis

Subject: Operations Support Projections for 1990

Attached are the Operations Support Projections for 1990 as received from the various groups involved in these programs. Please let me or Dr. Ferguson know whether additional information is needed.

Attachments

C. S. Kroustalis

cc: J. Charles
R. Ferguson
W. Kuhn

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: D. E. Leyden Date: January 16, 1990

From: P. F. Grantham

Subject: Operations Support - Projections for 1990

MATERIALS EVALUATION

Objective: To examine materials proposed for use in all PM USA facilities and render judgement as to their acceptability for the proposed use.

Operational Plans: Materials prosposed for use will continue to be analyzed and given recommendations. Presentations on the Materials Evaluation Program will continue to be made upon request. Tours will continue to be made at all PM facilities once each year to monitor material usage. An audit program to reevaluate previously analyzed products will be instituted to insure that vendors do not change materials being supplied to PM. Continue to assist QA in the analysis of foreign matter. Complete an assessment of the Materials Evaluation Program and institute needed changes.

Resources in man-years: 2.5

Primary contact person: P. Grantham, C-205, Ex-2438

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CUSTOMER COMPLAINTS

Objective: To provide analytical assistance to QA on customer complaint problems and to support quality improvement programs identified through consumer response.

Operational Plans: Continue analytical examination as needed for customer complaints. Continue to work with Mr. Crichton's Operations team and QA to address the Taste/Odor/Stale concerns.

Resources: 1.0 person.

Primary Contacts: D. Ingraham, C-2, Ex-5600, J. Crichton, OC, Ex-2376.

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: C. Kroustalis Date: February 6, 1990

From: W. R. Raymond

Subject: Operations Support, Flavor Development -- 1990 Strategic Plan

Per Don Leydon's request of January 16, 1990, following are Flavor Development Division Operations Support Program projections for 1990. Resource allocations are still under discussion and will be forwarded to you under separate cover when finalized. If you have any questions, please feel free to call me.

FLAVOR ANALYTICAL SUPPORT:

Objective: To provide analytical and troubleshooting support to Operations Services, Quality Assurance and Manufacturing in matters involving flavors or flavor-related problems.

Operational Plans: Analytical support and troubleshooting will continue as appropriate upon request. Support areas include out-of-spec. concentrates, preblends and finished flavors and casings, off-flavors or odors, foreign matter, ingredient problems, etc.

Resources in Man-years:

Primary Contact: R. Hale, OC/T3W, Ex-3642

NONTOBACCO MATERIALS SUPPORT:

Objective: To provide analytical and subjective evaluation support for the characterization and qualification of packaging materials, nontobacco cigarette components and other factory materials.

Operational Plans: Subjective panel evaluations will continue as appropriate upon request by Operations Services to qualify and/or characterize any new factory materials such as filters, papers, inks, adhesives, packaging materials, cleaners, etc. to ensure product subjective integrity. Headspace GC evaluation of packaging materials will continue as required for established and new brands.

Resources in Man-years:

Primary Contacts: Subjective Requests -- W. Bell, OC/T3W, Ex-4299
Analytical Requests -- R. Hale, OC/T3W, Ex-3642

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NATURAL GLYCERIN/TRIACETIN:

Objective: To develop analytical and subjective criteria necessary to qualify and specify all-natural glycerin-based triacetins from multiple vendors for interchangeable use as filter plasticizers.

Operational Plans: Subjective assessments are nearing completion to confirm natural:synthetic glycerin ratio used in the manufacture of Eastman Estrobond B. Eastman will convert this year from bulk glycerin feeding system to a constant metering system ensuring a constant natural:synthetic glycerin feed ratio as determined by Flavor Development subjective results. Analytical and subjective characterizations of synthetic and natural glycerins and triacetins from various vendors will continue in an effort to identify and classify impurities with respect to subjective quality. Direction will be provided to glycerin and triacetin vendors as appropriate to try to standardize both glycerin and triacetin to the highest possible subjective quality standards for interchangeable use in Manufacturing.

Resources in Man-years:

Primary Contact: R. Hale, OC/T3W, Ex-3642.

FLAVOR REVISIONS:

Objective: To subjectively test revised ingredients and/or flavors to qualify same for use in Manufacturing.

Operational Plans: Revision ingredients and flavors and Flavor Center submissions from Operations Services will continue to be evaluated and recommended for approval or further assessment.

Resources in Man-years:

Primary Contact: B. Taylor, OC/T3W, Ex-4288

FACTORY SUBJECTIVE SUPPORT:

Objective: To provide subjective panel testing services to Manufacturing to monitor new brand and test market start-ups, to troubleshoot subjective problems in filler and cigarettes and to qualify process and direct material changes.

Operational Plans: Subjective monitoring and troubleshooting activities will continue on an as-needed basis. Subjective testing for qualification of the MC Bulk-Handling process for reconstituted and Oriental tobaccos is expected to continue throughout the first half of 1990.

Resources in Man-years:

Primary Contact: W. Bell, OC/T3W, Ex-4299

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ETHANOL EMISSION REDUCTION:

Objective: To significantly reduce alcohol levels in PM flavor systems, and consequently factory environmental emissions, while maintaining product subjective integrity.

Operational Plans: Work will continue with Cambridge aftercut to reduce ethanol by 30% via preparation by a sonulation process. Analyses of flavors on filler and cigarettes, and subjective evaluations will continue. Alternative methods for sonulation will be investigated. POL testing of reduced-ethanol versus current flavor systems, for Cambridge and other brands as applicable, is planned to test for subjective parity.

Resources in Man-years:

Primary Contact: S. Ruziak, OC/T3W, Ex-2079

MARLBORO STANDARDIZATION:

Objective: To aid in the standardization of manufacturing processes and procedures among PM factories to ensure consistant quality and minimal variation in the Marlboro brand family.

Operational Plans: Current 1990 projections include three unscheduled factory pickups each of Marlboro and Marlboro Lights (all packings) which will be subjectively evaluated by the Marlboro Standard Panel. In addition, a standard run (VIII) is tentatively scheduled for August, 1990, in which all manufacturing locations (including Semi-works) will produce Marlboro and Marlboro Lights using the same flavors and, where applicable, the same cigarette and packaging materials. Cigarettes from Standard Run VIII will be subjectively tested both internally (Marlboro Standard Panel) and externally (POL). Selected analyses will be performed of ingredients, concentrates, preblends, finished flavors, blend components, finished filler and cigarettes to track production variation. The tentative schedule for Standard Run VIII is based on completion of the blend changeover to 1988 crop blend components.

Resources in Man-years:

Primary Contact: K. Deane, OC/T3W, Ex-4293

SUPPORT TO PROCESSING PLANTS:

Objective: To develop, evaluate, and/or optimize new additives, specifications and process changes to assure the subjective quality of reconstituted sheet materials.

Operational Plans: Subjective evaluations will continue on RL's made on Park 500 Line 3 to qualify the evaporator upgrade on that line. Qualification testing will continue for dry flavor replacement in RLB and for a range of sheet solubles in each RL. Internal subjective testing for the evaporator upgrade and dry flavor replacement is projected for completion during the first quarter. Efforts will continue to qualify an

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additional vendor source for roasted St. John's Bread native extract. Subjective support will continue for various processing plant tests, including additive levels and feedstock changes. R&D support projected to continue throughout 1990 includes subjective evaluation of alternate humectants, preservatives and processing aids such as Yankee release agents.

Work also is planned to continue for International sheet development. Strategies include tests of bonding agents and flavors in a companion sheet (ASTA-II) to blend with ASTA-I for substitution for RL's and RCB in PM brands in Spain. Flavor development also has been requested for RECA-I and -II to be utilized in Spanish brands.

Resources in Man-years:

Primary Contact: J. Swain, OC/T3W, Ex-5476

W. R. Raymond

cc: R. Ferguson
J. Myracle
H. Spielberg

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OPERATIONS SUPPORT -- 1990

RESOURCE SUMMARY

Support Program		Man-Years Projected	Man-Years Available
FLAVOR ANALYTICAL SUPPORT		0.30	0.10
NONTOBACCO MATERIALS SUPPORT	Analytical:	0.10	0.05
	Subjective:	1.00[1]	0.15[2]
		1.10	0.20
NATURAL GLYCERIN/TRIACETIN	Analytical:	0.20	0.05
	Subjective:	0.30	0.10
		0.50	0.15
FLAVOR REVISIONS	Analytical:	0.10	0.05
	Subjective:	0.25	0.05
		0.35	0.10
FACTORY SUBJECTIVE SUPPORT	Monitoring:	0.80	0.20
	Subjective:	0.10	0.10
		0.90	0.30
MARLBORO STANDARDIZATION	Analytical:	0.90	0.25
	Subjective[3]:	0.90	0.30
		1.80	0.55
SUPPORT TO PROCESSING PLANTS	Analytical:	0.10	0.05
	Subjective:	0.35	0.10
	Developmnt:	0.20	0.05
		0.65	0.20
PROJECT "GRAIN"		0.20	0.20
TOTALS:		**5.80**	**1.80**

[1] Based on 3 panels/week average last year.

[2] Two panels/month.

[3] Includes panel administration and FLD staff smoking.

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sent to [illegible] at
Leyden's request on
1/22/90

OPERATIONAL PLANS

TOBACCO SHEET IMPROVEMENTS

1990

Objective: Support efforts to improve the quality of PM USA sheets products/filler by investigating alternate methods of production.

1. Alternate Humectants

   Operational Plans: Continue to develop PG/G-free casings and flavors for use on small-scale produced cigarettes until subjective parity is obtained with a suitable control. Produce large-scale cigarettes based on the above model and determine survivabilities in the Primary and Make-Pack areas of the Semi-works. If the subjectives of these cigarettes are equivalent to the control, 2-POLs will be initiated about mid-year to qualify these materials.

2. RL Weak Liquor Preservatives

   Operational Plans: Of some 110 compounds tested, 14 have been identified as capable of preventing growth of test bacteria at levels of 250 ppm or less (Phase I agar inclusion and shake-flask assays). Five of these compounds have been tested and are capable of preventing bacterial growth and chemical changes in SEL (Phase III), while nine remain to be examined in that manner. Two of the compounds tested in Phase III (decanoic acid and β-cyclocitrylidene acetic acid) have been subjectively evaluated at appropriate levels in RL and rejected.

   Pending completion of another more urgent study, this effort has been suspended. In the Second Quarter, 1990, work will resume with completion of Phase III evaluation of the nine remaining compounds, followed by the subjective evaluation of as many as 12 compounds. Preservatives that are both efficacious and subjectively acceptable will be recommended for trial at Park 500 by the Fourth Quarter, 1990.

Resources in Man-years: 3.25

Primary Contact Person: R. McCuen, T-3, Ex-5851

2021554009

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

OPERATIONAL PLANS

TOBACCO MICROBIOLOGY

1990

MICROBIOLOGICAL QUALITY IMPROVEMENT PROGRAM (MQIP)

Objective: to eliminate, in all products and processes, microbial activities that produce unacceptable subjective changes (complete 1993).

Operational Plans:

Continue Hogshead/Box/Liner/Bale Study through 1992 as samples are received. Perform Semiworks Make-Pack Study (April-June 1990). Perform Water-Based Adhesives Study (July-August 1990) and Bermuda Hundred ART Plant Study (August-October 1990). Each of these studies will be conducted to measure microbial populations and their biochemical activities at each step in the manufacturing process so as to identify possible microbiological risks. Continue to provide microbiological support for Operations as requested.

Resources in Man-years: 3.5

Primary Contact Person: R. McCuen, T-3, Ex-5851

2021554010

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

PHILIP MORRIS U. S. A.

RECEIVED
JAN 25 1990
D. E. LEYDEN

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: D. E. Leyden

Date: January 23, 1990

From: J. L. Banyasz

Subject: Operations Support - Projections for 1990

Our projected operations support effort for 1990 is outlined below. Two members of project 1708, Dennis Driscoll and Pat Henderson, are committed full time to this area. All our operations support work is carried out in collaboration with the Applied Technology Group at 20th Street.

ENVIRONMENTAL COMPLIANCE

I. Objective: Develop and implement at plant levels, low energy and low capital cost technology equipment to assure the required levels of dissolved oxygen (4.6 mg/L) in the effluent from the Park 500 waste-treatment plant.

Operational Plans: Using bench scale laboratory studies, identify the best location(s) for equipment placement (intermixers(s) and pumps). Then perform the necessary scale-up and economic studies leading to full scale implementation.

Resources in Man-years: 0.5

II. Objective: Assess and develop ultrasonic dispersion technology for the removal of phosphorus from the effluent at the Park 500 waste-treatment plant.

Operational Plans: Using an ultrasonic mixer to mix and disperse chemicals, including polymers, at various locations at the waste-treatment plant, determine the required chemical concentrations as a function of phosphorus removal. Identify capital and operating costs as compared to other technologies.

Resources in Man-years: 0.5

CHARACTERIZATION OF MONOGRAM INKS

I. Objective: Develop incoming materials specifications for monogram inks.

Operational Plans: Using previously elucidated operating windows and press parameters presently being measured, define monogram ink specifications to be used by our purchasing department.

Resources in Man-years: 0.5

2021554011

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

II. Objective: Develop new monogram ink formulations that have more rapid setting times. These inks will be used on higher speed cigarette makers.

Operational Plans: Using modified binders, pigments, and oils, reformulate inks to have more rapid setting times without significantly affecting press properties.

Resources in Man-years: 0.5

cc: Central Files
B. A. Semp
J. F. Whidby

J. L. Banyasz

2021554012

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

SEMIWORKS SUPPORT

Objective: Use a small scale fabrication unit, the Semiworks, to provide cigarette production to evaluate new blends, new processes, new materials and other production related improvements to support PM USA programs.

Programs to be Supported

1. Marlboro Standardization.
2. Flavor Modification.
3. Offshore Tobacco Reduction.
4. Improvement of the Processing Plants.
5. Tobacco Lot Analysis.
6. Others as Needed.

Resources: 8.0 persons.

Primary Contact: J. Higgs, OC/SW, Ex-4368.

2021554013

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

BURLEY SPRAY

Objective: To evaluate the dry flavors used in burley spray and to provide written specifications.

Operational Plans: Individual incoming dry flavors will be evaluated and written specifications will be issued for future testing by Quality Assurance personnel.

Resources: 1.0 person.

Primary Contact: M. Zimmermann, C-201, Ex-5449.

2021554014

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: C. Kroustalis Date: January 22, 1990

From: M. Zimmermann

Subject: Project 1757 - Operations Support - Projections for 1990

FLAVOR SPECIFICATIONS

Objective: To develop analytical and sensory specifications for incoming flavors and materials for use at the Flavor Center and other QA facilities. The secondary objective is to provide analytical certification on PMI export flavors manufactured at the Flavor Center and other locations for FRG compliance to the German Food Ordinance.

Operational Plans: Specifications for the incoming materials will be operating in a vendor-by-vendor approach with at least two vendors currently on hand at any one time. These samples cover the variety of materials which are purchased - essential oils, botanicals, aroma chemicals, compound flavors and Liggett materials. There is approximately 385 different flavor materials. The Flavor Center personnel have been taught the methodology used and are currently analyzing some of the incoming materials using these specifications. In order for specifications to become a part of the operation of the Flavor Center for incoming materials these specifications must be agreed upon with the vendor and entered by E. Cook's group into the IBM System 36 computer.

Certification of the export flavor materials is now in the second phase of the program. Currently, there are a total of 21 flavor codes produced for Germany. All of these materials have been analyzed for compliance to the German Food Ordinance one time. This also includes the analysis for heavy metals and pesticides for each code. Only seven of these PMI flavor samples need certification for the second time. However, a new request for the analysis of Marlboro specific flavor materials will require that four of these codes be certified four times per year instead of the normal two. This responsibility and the procedures used will be transferred to Flavor Center personnel following the completion of the approved expansion of the Flavor Center. R. Spencer is currently on-loan from the Flavor Center to learn the procedures and equipment used in this program. This work will continue until the completion of the 650 expansion of the Flavor Center.

Resources: The group is composed of three members from the Analytical Research Division and two members on-loan from QA. 4.5 Man-years.

Primary Contact Person: M. Zimmermann, C-201, Ex-5449.

M Zimmermann

2021554015

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

ENVIRONMENTAL TOBACCO SMOKE

Objective: Compare the Portable Ambient Sampling System (PASS) developed by RJR with a similar ETS sampling system developed by TNO Research, Netherlands. Maintain these cases such that outside studies can be conducted with short notice.

Operational Plans: Both the PASS and TNO cases are portable briefcase-sized samplers which are used to collect and measure particulates, CO and nicotine unobtrusively in public environments. There are, however, a number of physical and operational differences between the two types of cases. The significance of these differences will be evaluated in a study using the 6-m^3 environmental chamber. With controlled levels of ETS, the accuracy and reproducibility of the two cases to measure particulates, CO and nicotine will be determined and compared. Additionally, the current procedures for operating the two ETS cases will be evaluated and recommendations for improved procedures will be noted. All eight PASS cases are currently ready for use. The TNO cases will be modified for use in the United States and made available for future studies.

Resources in Man-years: 0.5

Primary Contact Person E. Thomas B-217, Ex-3775

Objective: To Develop new methods and procedures for monitoring ETS and improve existing methods.

Operational Plans: A method was recently developed for monitoring ambient levels of ammonia associated with ETS. The reproducibility and accuracy of this method, compared to other procedures will be evaluated. Studies will be conducted to compare portable CO monitors based on electrochemical sensors with CO monitors based on nondispersive infrared systems. Preliminary studies have shown that the electrochemical CO sensors respond to other compounds in smoke besides CO. A portable analyzer for sulfur-containing gases will be evaluated for monitoring these compounds in ETS. An FTIR spectrometer will be used in developing an ETS monitoring system connected to the 6-m^3 chamber. This system will be used to measure a number of the light weight gases associated with ETS.

Resources in Man-years 2.5

Primary Contact Person: E. Thomas B-217, Ex-3775

2021554016

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

RECEIVED
JAN 24 1990
D. E. LEYDEN

PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: D. Leyden

Date: January 22, 1990

From: D. L. Faustini

Subject: Operation Support - Project 1101

KABAT® APPLICATION

Objective: Evaluate alternate application designs to provide a more homogenous and reliable method for total leaf protection.

Operational Plans: Continue to work with TQAF, LPF, and Engineering personnel to: (1) develop alternate application sites for optimizing uniform KABAT® coverage; (2) evaluate new KABAT® applications for efficacy and uniformity on target surfaces; (3) implement necessary changes.

Resources in man-years: 1.5

INSECT CONTROL MANUAL (ICM)

Objective: To provide a manual containing basic instructions and procedures for persons who are directly responsible for the control of insects infesting stored and processed tobaccos.

Operational Plans: Manuals will be distributed by Entomology Project 1101 members to PM USA and PM Inc. personnel via the assistance of the Tobacco Technology Group (TTG). Visits will be made to area locations to review current integrated pest management (IPM) practices and train/report present IPM strategies consistant with the ICM. Continue to assist TTG in these efforts.

Resources in man-years: 0.80

PHYTOSANITARY CERTIFICATION (Export Cut Filler)

Objective: To examine the present method of tobacco conditioning using vacuum-steam as a process systems design for obtaining phytosanitary certification.

Operational Plans: Review completion report with representatives of Agriculture Research and the Animal Plant Health Inspection Service. Request authorization of the probe-equipped conditioning unit cycle and an additional compliance agreement. Assist Engineering and Manufacturing personnel in implementing the recommendations.

Resources in man-years: 0.5

2021554017

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

PROTECTING PROCESSED TOBACCO IN STORAGE

Objective: To eliminate the use of Tyvek® liners for expanded products in storage.

Operational Plans: Continue to provide support to PM Engineering personnel to: (1) evaluate the use of KABAT® as an alternative method to protect processed tobaccos against CB infestation; (2) investigate applying KABAT® to expanded products at drop points in the conveyor system, or reordering cylinder.

Resources in man-years: 1.0

INSECT RESISTANCE

Objective: To determine if cigarette beetles have developed phosphine resistance.

Operational Plans: Collect wild and lab-raised susceptible CBs and submit to USDA lab for bioassay (resistance evaluation). Write completion report and present findings to R&D and QA management.

Resources in man-years: 0.2

The primary contact person in all cases is D. Faustini, T-327, Ex. 5795

cc: J. L. Charles
C. K. Ellis
R. W. McCuen

Daryl Faustini (RWMcC)

2021554018

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

PROJECT WARHOL

Objective: To support R&D Europe in conducting trials to evaluate the effects of differences in PM Europe and PM USA DIET feedstocks and process conditions on product physical properties.

Operational Plan: The USA portion of the test plan was completed in the Manufacturing Center the week of Febraury 12, 1990. On line of DBC Bright and on laydown of PM Europe feedstock were expanded at PM USA operating conditoins. The European portion of the trials will be carried out in Berlin the week of March 11, 1990. The Berlin trials will consist of expansion of USA and European feedstock tobaccos at both PM USA and PM Berlin operating conditions. The final project report will be issued by PM Europe R&D.

Resources in man-years: 0.2

Primary Contact Person: H. Alonso

2021554019

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

ENGINEERING STUDIES

Objective: To provide analytical support to the various Engineering studies listed below.

1. Hogshead/Box/Bale storage. 1.0

2. Kabat application improvements and survivability. 2.5

3. Bulk handling. 1.5

4. Park 500 residue disposal. 0.25

5. QA laboratory support. 0.5
   a. Methodology
   b. Technical support
   c. Reference materials

2021554020

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

2021554021

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

CONFIDENTIAL

PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

RECEIVED
OCT 8 1990
CLIFF LILLY

To: C. L. Ellis **Date:** October 4, 1990

From: W. T. Callaham WTC

Subject: FILTRATION RESEARCH PROGRAM - 1991 OPERATIONAL PLAN

OBJECTIVE: Provide filtration research support for the development of new and/or improved products.

STATUS AND BACKGROUND: The Filtration Research program was initiated in 1987 as a collaborative effort between Cigarette Technology and Physical Research. Since that time, fundamental research has been initiated and completed in the areas of design modelling, novel vendor filters and filter materials, web filter development, carbon characterization, alternative plasticizers, filter additives, menthol stability, filter manufacturing, smoke studies and spent filter odor.

STRATEGIES:

1. Develop new or unique filtration systems.
2. Support new product development
3. Support the existing business through:
   a. Product uniformity improvements
   b. Cost reductions
   c. Alternative materials

cc: Dr. J. L. Charles
Mr. P. N. Gauvin
Dr. K. S. Houghton
Dr. A. C. Lilly
Mr. J. L. Myracle

2021554022

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

TACTICS AND TIMETABLE:

STRATEGY 1 - DEVELOP NEW/UNIQUE FILTRATION SYSTEMS

Reduce priority on Celanese CA paper, but evaluate new materials as they become available.	Through 1991
Investigate cellulon in a PM CA paper.	4th Qtr 90
Optimize PM CA paper at James River Corp.	4th Qtr 90
Large scale paper mill run of PM Paper	1st Qtr 91
Optimize pulp acetylation at USDA Forest Products Laboratory for pilot paper making trial.	4th Qtr 90
Investigate pulp/paper acetylation at Courtaulds Fibers.	1st Qtr 91
Large scale acetylated paper mill run.	4th Qtr 91
Investigate additives coated on Tela paper to give CA-type subjectives.	4th Qtr 90
Investigate solvent coating of CA on Tela paper using superheated steam drying.	4th Qtr 90
Large scale paper coating mill run.	3rd Qtr 91
Evaluate Kimberly-Clark melt-blown and coformed polypropylene (with and without the addition of carbon, cellulose, CA, and/or triacetin); and, samples of tobacco and cellulosic papers with carbon.	4th Qtr 90
Commercialize and optimize paper/CA concentric filters.	1st Qtr 91
Evaluate other novel vendor filters as they become available.	Ongoing 1991
Evaluate ultra-low denier per filament tow items as they become available.	Ongoing 1991

STRATEGY 2 - SUPPORT NEW PRODUCT DEVELOPMENT

Apply paper/CA concentric filters to new products.	Through 1991
Evaluate Filtrona's SCS-III and UHF filters on new products.	4th Qtr 90
Evaluate Eastman's citric acid-in-dope filters.	4th Qtr 90
Support the filter requirements of R&D programs such as BOLD, ART, B&H Denic, Half-Nic, Tomorrow, Lotus, Trim, Ambrosia, and Sigma.	Ongoing 1991
Support the filter requirements of PM International such as EEMA/EEC, Australia, Korea, etc.	Ongoing 1991
Maintain close liaison with PM Europe R&D and Intertaba.	Ongoing 1991

2021554023

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

TACTICS AND TIMETABLE:

STRATEGY 3 - SUPPORT THE EXISTING BUSINESS

Specify the optimal carbon OV, size and activity for PM carbon-filtered brands.	4th Qtr 91
Qualify PICA and Calgon as sources of the same carbons.	2nd Qtr 91
Qualify a coconut-based carbon as a substitute for coal-based carbon.	2nd Qtr 91
Evaluate the effect of impregnants on selective carbon performance.	Ongoing 1991
Support the implementation of an incoming carbon testing program.	1st Qtr 91
Develop a carbon activity measurement using TGA.	1st Qtr 91
Qualify triethyl citrate as a substitute for triacetin.	1st Qtr 91
Evaluate other new plasticizers as they become available.	Ongoing 1991
Develop a more precise additive/plasticizer application technique using ultrasonic nozzles.	4th Qtr 90
Qualify new precoated porous plug wraps from Kimberly-Clark for use on Lark Milds.	4th Qtr 90
Assist Operations Services in qualification of Ecusta precoated porous plug wrap.	4th Qtr 90
Complete evaluation of MPF wrapless filters.	1st Qtr 91
Evaluate filter additives for their effect in reducing ash tray odor.	Ongoing 1991
Evaluate biodegradable filter materials as they become available.	Ongoing 1991
Maintain close liaison with vendors such as Eastman, Celanese, Filtrona, Rhodia, Kimberly-Clark, James River, and Courtaulds for new developments which could improve existing operations.	Ongoing 1991
Support Physical Research in filter design modelling.	Ongoing 1991

2021554024

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

RESOURCE ALLOCATION:

R&D DIVISION	REQD	AVAIL	DIFF
Cigarette Technology	10.0	10.0	0
Physical Research	0.5	0.5	0
Tobacco Processing and Fabrication	1.0	**0**	**(1.0)**
Cigarette Testing Services	0.5	0.5	0
Technology Assessment	0.5	**0**	**(0.5)**
Flavor Development	0.6	**0.3**	**(0.3)**
Cigarette Development	0.2	**0**	**(0.2)**
Product Evaluation	0.2	**0**	**(0.2)**
Chemical Research	0.5	**0.05**	**(0.45)**
Analytical Research	0.5	0.5	0
Computer Applications	0.2	0.2	0
Total allocation	14.7	12.05	**(2.65)**

Currently there is a projected resource shortage of 2.65 people.

Special people required: 1 chemist in the Filter Development group of Cigarette Technology.

Equipment required:
- Off-line laser perforator
- High-speed filter paper slitter
- Plug-space-plug combiner
- 4 up x 108 combiner for 20+7 filter tip
- 4 up x 126 combiner for 24.5+7 filter tip

No additional outside expertise, other than that currently employed, is required.

2021554025

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

IMPACT ON OPERATIONS:

INTERNAL TO R&D:

Improved capabilities for assisting other groups
Faster filter/cigarette design process
New product development

EXTERNAL TO R&D:

Improved filter making operations
Optimized product quality
Reduced product cost
More alternative materials
More new products
Faster new product implementation

2021554026

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

FILTRATION RESEARCH PROGRAM
ABSTRACT - SEPTEMBER 17, 1990 PLANNING MEETING

GOAL: Provide filtration research support which will allow for development of new or improved products.

STRATEGIES: Support the existing business; support new product development; develop new or unique filtration systems.

RESOURCE REQUIREMENTS: 13.0 personnel.

PAPER FILTER DEVELOPMENT:

Celanese CA Paper: Recent samples are not acceptable due to poor formation and RTD variability. Efficiency remains ~5% higher than cellulosic paper. Priority will be reduced and new materials evaluated if received.

Philip Morris CA Paper: Materials made at University of Maine have improved. Efficiency is comparable to cellulosic paper but subjectives are not consistent. Plans are to investigate cellulon and pursue further paper making at James River Corp.

Pulp Acetylation: Initial trials have begun at USDA Forest Products Lab. Plans are to acetylate enough pulp for a pilot paper making trial at James River or Univ. of Maine. Courtaulds Fibers is investigating feasibility of acetylation at their location.

Paper Coating: Additives are being coated on Tela paper at James River Technical Center to give CA-type subjectives. Solvent coating of CA with superheated steam drying is being tried at James River Richmond. Samples will be evaluated and a selection made for larger scale trials.

Other Papers: Kimberly-Clark is preparing samples of melt-blown and coformed polypropylene papers, some with addition of carbon, cellulose, CA, and/or triacetin. Also, being prepared are tobacco and cellulosic papers with carbon. Samples will be evaluated and a selection made for larger scale trials.

NOVEL FILTER DEVELOPMENT:

CA Concentric Filters: No advantages have been found for CA concentric filters on domestic PM products. Testing will be discontinued except as a service for international work.

Paper/CA Concentric Filters: A CA concentric filter with a paper core has been developed and applied to the current BOLD products. A US patent has been filed and exclusivity obtained with Filtrona for manufacture. Plans are to commercialize, optimize and apply to other products.

Other Novel Filters: Work is in progress with Filtrona's SCS-III and UHF filters; and, with Eastman's citric acid-in-dope filters.

2021554027

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

OTHER PROGRAMS:

Work is in progress in the areas of carbon studies, alternate plasticizers, plug wrap technology, and filter modelling.

2021554028

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: [redacted] **Date:** March 29, 1990

From: Tim Callaham and Bill Dwyer

Subject: FILTRATION RESEARCH - 1990 OPERATIONAL PLANS

There are no significant changes in the 1990 Filtration Research operational plan since that document was distributed on 2/14/90.

cc: J. Charles
P. Gauvin
C. Lilly
J. Myracle
J. Whidby
Central Files

2021554029

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. A. C. Lilly Date: February 14, 1990

From: W. T. Callaham and R. W. Dwyer

Subject: FILTRATION RESEARCH - 1990 OPERATIONAL PLAN

OBJECTIVE: To provide support in the area of filtration research which will allow for the development of new or improved products such as:

1. Low-tar product (6mg) with no ventilation.
2. Ultra-low tar product (2mg) with a maximum of 35% ventilation.
3. 1, 2, and 3mg products that are subjectively preferred over Now, Carlton, and Kent III.
4. A menthol product that delivers the same amount of menthol regardless of age or storage conditions.
5. Product which selectively alter the particle size or gas phase constituents.

STRATEGIES:

1. Develop improved or unique filtraton systems.
2. Provide filter support for new product development.
3. Support the existing business through:
   a. Product uniformity improvements
   b. Cost reductions
   c. Alternate materials

cc: Dr. J. L. Charles
Mr. P. N. Gauvin
Dr. K. S. Houghton
Mr. J. L. Myracle
Dr. J. F. Whidby

2021554030

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

TACTICS AND TIMETABLE

STRATEGY 1 - DEVELOP IMPROVED/UNIQUE FILTRATION SYSTEMS

Complete evaluation of cigarettes made with CA web filters.	1st quarter
Evaluate variability and performance of improved CA web samples made at Dexter and Kimberly Clark.	2nd quarter
Evaluate 1.4/30000 CA tow filters in a MUL configuration.	1st quarter
Complete evaluation of Eastman experiment on menthol stability.	1st quarter
Complete concentric filter matrix study.	1st quarter
Analytically evaluate smoke from core and periphery of concentric filters.	2nd quarter
Evaluate use of concentric filters for improved menthol delivery.	1st quarter
Evaluate use of alternating concentric filters on ultra-low tar products.	1st quarter
Evaluate concentric filters with higher efficiency materials in the core for enhanced peripheral smoke delivery.	4th quarter
Evaluate different smoke trajectory patterns on subjectives.	2nd quarter
Evaluate Astra filters as a substitute for plastic fluted filters.	2nd quarter
Develop and evaluate filter additives for subjective enhancement of paper filters.	1st quarter
Complete evaluation of PM web samples from Univ. of Maine.	1st quarter
Optimize processing and filter-making of PM web and evaluate on new products.	2nd quarter
Optimize performance of web filter maker.	Ongoing 1990
Optimize paper acetylation process and evaluate filters.	1st quarter
Develop and evaluate paper filters with CA coatings.	2nd quarter
Evaluate peripheral bypass filters from Celanese for enhanced subjectives on low tar products.	2nd quarter

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

TACTICS AND TIMETABLE

STRATEGY 1 - DEVELOP IMPROVED/UNIQUE FILTRATION SYSTEMS (continued)

Evaluate filter webs incorporating tobacco and/or tobacco solubles for enhanced subjectives in low tar products.	3rd quarter
Evaluate Rhodia filter discs on ultra-low tar products.	1st quarter
Design and evaluate filters to alter the particle-size distribution of mainstream smoke using impactors and electrostatics.	4th quarter
Maintain close liason with vendors such as Celanese, Eastman, Rhodia, and Filtrona for new developments which could lead to improved filtration systems.	Ongoing 1990

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

TACTICS AND TIMETABLE

STRATEGY 2 - PROVIDE FILTER SUPPORT FOR NEW PRODUCT DEVELOPMENT

Utilize the cigarette design model as a tool for developing and evaluating unique/improved filter systems on new products.	Ongoing 1990
Incorporate novel filter designs into all of the low delivery programs.	4th quarter
Model the effects of expanded tobacco content on cigarette performance.	1st quarter
Model the effects of cigarette design on sidestream TPM and visibility.	1st quarter
Provide modeling capability for multi-stage filter systems.	2nd quarter
Provide modeling capability for puff-by-puff profiles of TPM, tar, nicotine, and water.	4th quarter
Provide modeling capability for paper filters.	1st quarter
Provide modeling capability for carbon on CA filters.	2nd quarter
Provide modeling capability for polypropylene and CA web filters.	4th quarter
Develop fluid dynamic flow patterns for tobacco rods and filters.	2nd quarter
Develop an expert-system based program for enhanced cigarette design capabilities and ease of use.	3rd quarter
Implement the cigarette design program in Operations Services, QA, Leaf, and FTR.	1st quarter
Incorporate the International CI, QA weekly audit, and TLS data-bases into the design program.	2nd quarter
Support the filter requirements of other R&D programs such as ART, Low Tar/High Taste, Tomorrow, Lotus, B&H Low-Nic, Sigma and Japan.	Ongoing 1990
Support the filter requirements of PM International such as EEMA/EEC, Australia, Korea, etc.	Ongoing 1990
Maintain close liason with PM Europe R&D and Intertaba.	Ongoing 1990

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

TACTICS AND TIMETABLE

STRATEGY 3 - SUPPORT THE EXISTING BUSINESS

Complete evaluation of Rhodia super-crimp tow as a means of reducing filter tow weights for a given RTD.	1st quarter
Evaluate improved Rhodia tongue on filter-making performance.	2nd quarter.
Complete qualification trials of Ecusta porous plug wrap for use on Lark products.	1st quarter
Evaluate new porous plug wraps from KC on Lark products as they become available.	2nd quarter
Complete evaluation of new plasticizers as a substitute for triacetin in Marlboro Lights.	1st quarter
Evaluate other new plasticizers as they become available.	Ongoing 1990
Evaluate effect of OV, size and activity of carbons on subjectives and gas phase deliveries.	2nd quarter
Complete evaluation of carbon loading versus activity on subjectives and gas phase deliveries.	1st quarter
Evaluate effect of aging on carbon filtered cigarette subjectives and gas phase deliveries.	2nd quarter
Complete evaluation of tri-ethyl citrate on improved menthol stability and carbon absorption.	2nd quarter
Complete study of coal-base versus coconut-base carbons.	1st quarter
Investigate the variability of incoming carbon shipments and implement QA testing if required.	1st quarter
Evaluate filter additives for their effect in reducing or eliminating ash tray odor.	Ongoing 1990
Evaluate biodegradable filter materials as they become available.	Ongoing 1990
Maintain close liason with vendors such as Celanese, Eastman, Rhodia, and Filtrona for new developments which could improve existing operations.	Ongoing 1990

2021554034

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

PROJECTED RESOURCE ALLOCATIONS

Cigarette Technology	7.0
Physical Research	2.5
Product Development	0.6
Flavor Development	0.3
Product Evaluation	0.2
Tobacco Materials	0.4
Tobacco Processing and Fabrication	0.5
Chemical Research	0.1
Analytical Research	0.1
Computer Applications	0.5
Cigarette Testing	0.5
Technology Assessment	0.5
	13.2

NOTE: Resource allocations to remain constant throughout 1990.

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TECHNOLOGY TRANSFER

RECIPIENT	TECHNOLOGY	DATE
New Product Development	Filter system for 6mg, no ventilation product.	3rd quarter
	Filter system for 2mg, ≤35% ventilation product.	3rd quarter
	Filter system for 1mg, 2mg, 3mg products.	2nd quarter
	Filter system for a stable menthol product.	4th quarter
	Filter system which selectively reduces certain smoke constituents for improved subjectives.	4th quarter
	Other novel filter systems.	Ongoing 1990
PM Int'l	Novel filter systems.	Ongoing 1990
QA, Leaf, FTR Ops. Svs.,	Cigarette design model.	1st quarter
Engineering	Improved Rhodia tongue.	3rd quarter
Oper. Serv.	1.4 denier per filament tow.	4th quarter
	Tri-ethyl citrate plasticizer.	4th quarter
	Optimized carbon.	4th quarter
	KC porous plug wrap.	4th quarter

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. C. K. Ellis **Date:** October 1, 1990

From: Ted Sanders

Subject: **Abstract of Paper Technology Presentation at Third Quarter R&D Planning Meeting**

The Paper Technology Program contributes to six current R&D areas; namely, reduced sidestream (Project Lotus), Project Ambrosia, Project Tomorrow, web filters, novel papers to control ash flaking, and improved tipping papers. All of these areas were discussed with the exception of web filters. The web filter area had already been covered by the Filter Technology presentation. A short summary of each area is given below.

A. Reduced sidestream

Three strategies were discussed; optimization of "high basis weight" papers, investigation and development of alternate inorganic fillers, and mechanistic studies. High basis weight papers are currently being developed for three potential products: 1) a low smoke product for Project Ambrosia, an improved Superslims, and a low sidestream product for Japan. The paper being developed for Project Ambrosia is a 45 g/m^2 basis weight paper. At present effort is being devoted to improving sidestream reduction of Ambrosia papers without sacrificing subjectives. This is being done by investigating the use of carboxylic acids in conjunction with mono potassium phosphate, looking at alkali metal salt/acid mixtures as fluxing agents, looking at slight increases in basis weight, and investigating papers with increased amounts of inorganic filler. Tactics for an improved Superslims paper are very similar, although papers with increased porosity will also be looked at. Finally, with respect to a low sidestream paper for Japan no alterations to the current paper (63 g/m^2 basis weight with a fluxing agent consisting of a mixture of mono potassium phosphate and malonic acid) are planned, since any change would result in increased sidestream visibility.

Current investigations into alternate inorganic fillers are focusing on various forms of magnesium carbonate. Magnesium carbonate fillers can be divided into two main areas - crystalline forms and amorphous forms. The amorphous materials are derived by a sol-gel route. The crystalline form of magnesium carbonate receiving the most attention is magnesite. Magnesite has previously been shown to effectively reduce sidestream smoke, and we are in the process of obtaining sufficient amounts of both natural and synthetic magnesite to make large quantities of paper. Mined magnesite (Baymag) is being ground to provide at least two thousand pounds of material so paper can be machine-made at Ecusta in mid October. Once this paper is on hand, product development work can start. At the same time we are optimizing

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the synthesis of magnesite so that it can be scaled up to provide sufficient material to make paper at the University of Maine. The synthetic material should be available at the end of 1990. Three sol-gel routes, two in-house and one at NY Poly, are also being looked at to provide amorphous magnesium carbonates. These routes are currently being optimized, and data on hand-made cigarettes are being obtained. In order to fully understand the chemistry involved in sol-gel derived magnesium carbonates, we intend to initiate studies on the aggregation of the particles after they are formed.

Studies designed to elucidate the mechanism by which magnesium carbonate fillers reduce sidestream smoke are in progress. Projects which will be completed in the fourth quarter include determining the location and behavior of visible smoke plumes, evaluating BET surface areas of papers and chars, and evaluating temperature of paper surfaces during static burn. It is planned to initiate a major program in 1991 to study the effect of permeability of ash and paper on the delivery of gas phase components and aerosol precursors.

B. Project Ambrosia

In addition to the work mentioned above, the Paper Technology Program is assisting in the evaluation and development of flavor-release compounds. Currently the major emphasis is on compounds which will release α-hexylcinnamaldehyde. We are currently looking at a new material, Aromatek 625, a tartaric acid acetal, in order to determine if it is a more effective release agent than Aromatek 245. Work devoted to the synthesis of an entirely new system for the release of α-hexylcinnamaldehyde was also discussed.

C. Project Tomorrow

The objective within the Paper Technology Program with respect to Project Tomorrow is to develop procedures which will provide a "banded" paper to control burn rate. Three strategies were discussed; namely, the daubing dandy, printed bands, and paper bands. Most of the effort is currently being devoted to the daubing dandy, a technology which deposits bands of cellulose on the paper on the Fourdrinier wire. The current status of this program was discussed. Plans are to evaluate papers made at the University of Maine in August, carry out one more run at the University of Maine, and initiate the design of a modified Fourdrinier wire.

Considerable work has been devoted previously to applying burn retardant chemical bands on paper using a rotogravure press. None of this work has been successful. Recently, however, a material has been found which appears to be promising; namely, the hexa potassium salt of phytic acid. Evaluation of this material should be complete by the end of October.

Lastly, PM Engineering is modifying a Max-S tipper to apply bands of a dense paper. Prototype development should be complete in one to two months.

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D. Papers to control ash flaking

The objective is to develop a paper which will control ash flaking on ultra low delivery products such as Marlboro Ultra Lights or Bold. Tactics are to increase paper basis weight, increase the level of potassium ion, increase the surface area of the chalk, and increase chalk content. All of these have been investigated on hand sheets, and the most promising tactics appear to be increasing the surface area of the chalk and increasing the chalk content. Papers incorporating these modifications are scheduled to be made at the University of Maine in October.

E. Tipping papers

The two areas presently being investigated with respect to tipping papers are filter flare-up and lip release. Filer flare-up is a problem only with cork-on-white tipping. It has been shown that maintaining the ink application level under 3.5 g/m^2 and reducing the silicate level of the ink essentially eliminates the filter flare-up problem. Plans are to obtain sufficient amounts of the modified tipping paper form Colonial Heights to qualify this material, and to develop the necessary QA methods.

Lip release is a problem only with white tipping. Plans are to complete our evaluation of "improved" tipping paper obtained both from Kimberly-Clark and Ecusta, and if the evaluation warrants further work, to investigate the machinability of the "improved" tipping papers.

Tcl

cc: S. Baldwin
P. Gauvin
C. Lilly

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Revised

PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Distribution **Date:** April 9, 1990

From: Cliff Lilly Cliff p

Subject: **Updates - 1990 Operational Plans**

There were no significant changes to the 1990 Operations Plans as a consequence of the first quarter R&D Planning meeting. However, the Paper Technology Plan has been updated in a number of areas, and a revised version of this is attached for insertion in the Operations Plan Book.

/s
Attachment

Distribution
M. C. Bourlas
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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. Cathy Ellis

Date: April 9, 1990

From: Ted Sanders

Subject: **Paper Technology Plan**

Although there were no changes to the Paper Technology Plan for 1990 as a consequence of the first quarter R&D planning meeting, the plan has been updated in a number of areas. Consequently, I am sending you a revised version.

Ted

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Paper Technology/Reduced Sidestream Plan

February 15, 1990

I. Introduction

The paper technology program has as its overall objective the development of proprietary cigarette papers for new products. The specific applications at this time are: 1) products with reduced sidestream visibility; 2) products for aroma modification of sidestream; 3) papers which will allow control of burn rate for Project Tomorrow; 4) development of filter materials which can be used to make filters with surface areas equivalent to paper filters, but with surface adsorption characteristics similar to cellulose acetate At this time the first goal, cigarettes with reduced sidestream visibility, is by far the highest priority. Consequently the majority of this plan will be devoted to that topic. Plans regarding the remaining three topics are restricted to the specific areas involving the development of new papers.

II. Products with Reduced Sidestream Visibility

A. Objectives

1. To develop a proprietary cigarette wrapper which will reduce visible sidestream smoke by at least 70% in a full circumference cigarette, as compared to an appropriate control, with acceptable subjectives by 1990.

2. To develop proprietary cigarette wrappers which will in addition to reducing sidestream visibility will reduce sidestream odor and irritation.

The second objective has been added in 1990. Little work is planned to take place addressing this objective in 1990. It is anticipated, however, that by the end of 1990 several satisfactory prototypes with reduced visibility will have been completed. Resources will then be phased into development of products with reduced odor and irritation. A brief outline of the plans for this phase of the project for 1991 and following years is given in Appendix A.

B. Introduction and Status

Philip Morris has been working on cigarettes with reduced sidestream visibility for about eight years. Work was initiated with the introduction of a commercial reduced sidestream brand, Passport, in Canada, and has grown in importance during the intervening years as a consequence of the public's growing, although misplaced, concern over passive smoke. Passport utilized a paper manufactured by Ecusta containing 12% magnesium hydroxide. The product had serious subjective problems and was not a commercial success. During the first five years that R&D has been involved in a reduced sidestream program we depended on our two suppliers, Ecusta and Kimberly-Clark, to provide us with low sidestream papers. Three years ago, however, a decision

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was made to attempt to develop our own low sidestream paper. This was done first of all because our suppliers have not been strikingly successful in providing us with a paper which will achieve our objectives. More importantly, however, is that it is essential that we develop our own proprietary paper to obtain a clear competitive advantage. In 1989 we developed a slim cigarette with sidestream reduction which met our target and acceptable subjectives. This product utilizes a double wrap system. The outer wrap was developed jointly by PM and Kimberly-Clark. It has a 45 g/m^2 basis weight, contains 35% calcium carbonate with a surface area of 20 m^2/g, and contains potassium succinate, monoammonium phosphate (MAP) and sodium carboxymethyl cellulose (CMC) as additives. The inner wrap is a thin (18 g/m^2) paper with 3% low surface area calcium carbonate and 2% potassium citrate. This product was introduced nationally in September, 1989, and appears to be doing reasonably well. Neither the system used on the slim cigarette nor the Ecusta magnesium hydroxide paper, however, has proved to be satisfactory for a full circumference cigarette. The best sidestream visibility reduction which has been achieved for a full circumference cigarette using the double wrap system is about 65%, below our target of 70%. In addition, there are clear taste problems. The magnesium hydroxide wrapper will give greater than 70% sidestream visibility reduction, but with severe subjective problems. Not only are there definite taste problems, but ash flaking problems as well. Despite the drawbacks of the magnesium hydroxide wrapper, RJR recently test marketed a low sidestream product, Vantage Excel. We regard this product to be unacceptable, and the product was withdrawn from test market in late 1989.

It can be concluded from the above discussion that the only way in which PM can successfully reach the goal of an acceptable full circumference product with greater than 70% sidestream visibility reduction is to design our own paper. In order to accomplish this goal we needed to develop certain resources to allow us to carry out research and development in the area of paper technology. In the past year we have built and equipped an in-house facility to fabricate hand sheets using flax fibers; we have negotiated a contract with the University of Maine to make pilot quantities of papers; we have developed an in-house inorganic chemistry group to investigate the chemistry of paper fillers; we have initiated work in the area of sol-gel chemistry to develop inorganic fillers with novel morphologies and surface charge, and have obtained consultants to assist us with this work; we have installed a sidestream chamber, similar to the facility at Neuchatel, to be able to carry out studies on sidestream smoke; we have designed and built an eight-port smoking apparatus to rapidly measure sidestream visibility; and we have put our two major paper suppliers on notice that we plan to conduct programs with them in a collaborative manner, so that we receive exclusivity on any papers which may result from such programs. In order to achieve the objective of developing a proprietary paper which will reduce sidestream visibility in a full circumference cigarette, we have delineated seven major strategies. These strategies are:

1. Develop "high basis weight" papers as low sidestream wrappers for full circumference cigarettes.

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2. Investigate and develop alternate inorganic fillers.

3. Investigate and develop alternate fluxing agents.

4. Carry out fundamental studies to determine the mechanism by which low sidestream papers reduce sidestream visibility.

5. Develop and optimize products using experimental papers.

6. Define the subjective and analytical characteristics of mainstream smoke from a calcium carbonate, dual wrap low sidestream prototype compared to an appropriate control.

7. Characterize the chemistry of sidestream smoke from existing brands, new products and prototypes using the new sidestream chamber.

An eighth strategy discussed in last year's plan - develop techniques for measuring visible sidestream smoke and sidestream particulates - is no longer included, since we have completed our work on this strategy.

Each of these strategies will be discussed below. A brief discussion of current status will be given followed by the specific tactics, along with target dates, which will be used to realize each strategy.

C. Strategies and Tactics

1. Develop "high basis weight" papers as low sidestream wrappers for full circumference cigarettes

a. Status

Development of a paper to yield a 65-70% reduction in sidestream visibility for a 24.8 mm circumference 100 mm cigarette has been the primary objective for this strategy during the past quarter. As was mentioned in the June, 1989, plan the original objective of this strategy was to determine if a dual wrap system could be replaced with a single wrap. Two types of wraps were investigated. One was a "bilayer" sheet made with a dual headbox system in such a way so that there was a difference in calcium carbonate levels between the inner and outer portions of the sheet. The second was a paper made to the same basis weight (63 g/m^2) as the bilayer sheet, but with a uniform distribution of the calcium carbonate. This latter sheet is called a "high basis weight" paper. The basis weight of 63 g/m^2 was chosen since it was the sum of the two wraps used for Trim V. Of the two types of paper, the high basis weight paper has given the more promising results. Considerable work with this paper has shown that to achieve significant sidestream reduction it is necessary to have a low porosity sheet (3-5 Coresta), a high concentration of potassium must be used, and a sufficient

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level of an appropriately chosen inorganic salt must be added to function as a burn retardant. The best results have been obtained by coating the paper with between 10 and 12% mono potassium phosphate. The potassium phosphate acts both as a source of potassium ion to provide good sidestream reduction and as a burn retardant. Although other potassium or sodium salts will give similar sidestream reductions, mono potassium phosphate has provided cigarettes with the best subjectives to date. A number of different models have been made, and sidestream reductions range from 65-68%.

An agreement has been signed by Kimberly-Clark giving PM exclusive use of this paper for a two year period. A patent covering this paper has also been filed. Kimberly-Clark has supplied us with 500 pounds of four papers with the following specifications: basis weight, 63 g/m^2; porosity, 2.9 and 4.2 Coresta; inorganic filler, Multifex MM calcium carbonate; level of inorganic filler, 26 and 36%. Cigarettes were made from these four papers using an amount of mono potassium phosphate calculated to give equal sidestream reduction. Based on subjective evaluation of these models, paper E2560 (4.2 Coresta, 36% calcium carbonate) has been selected for further work. Ongoing studies designed to optimize the subjective response of cigarettes made with this paper include screening of new blends, development of new aftercut flavors and casings, investigation of other additives on the wrappers to reduce sidestream irritability, optimization of packing density, and studies on the correlation of filler OV with subjective response.

New blend formulations have been developed by the Leaf Department in an effort to improve the tobacco character of the cigarette. Blend 218 gave improvements in subjective performance, but fell short of the sidestream reduction target. Blend 231 was formulated based on the 218 blend using more recon to reduce visible sidestream smoke. Testing of the 218 blend is in progress. An aftercut formulation containing methyl jasmonate was recommended by Flavor Development and is being tested on Marlboro blend, our standard reference blend. Initial sidestream panel testing indicates a significant difference in ratings for the methyl jasmonate aftercut. Further testing will tell whether the difference is in the direction of more tobacco character. Several materials have been added to the paper in order to reduce both sidestream irritability and mainstream "paper taste." These materials include sugars, MAP, MAP plus fructose, amino acids and lactic acid. Most promising have been the lactic acid samples. Further work is planned in this area.

One frequent response to cigarettes made with the high basis weight paper is 'dry taste.' To determine if the heavily sized paper extracts water from the tobacco, filler OV's were measured on packaged cigarettes with both

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conventional and 65 g/m² wrappers after 6 and 12 weeks of storage at laboratory conditions. No difference in filler OV was found between the two wrappers. Conventional and 65 g/m² papers were equilibrated at 60% relative humidity and tested for moisture content; both contained 6% OV. Lastly, cigarettes stored under two different types of conditions which differed by at least one OV unit were smoked subjectively. No major difference could be perceived between the two models. Therefore, the dry taste does not appear to be caused by an altered distribution of moisture in the cigarette. No further work will be done in this area except to determine an optimum OV level once a satisfactory model has been developed.

b. **Tactics and timetable**

(1) Complete investigation of different blends including Blend 231, Blend 213, and the L&M blend - first quarter, 1990.

(2) Continue to develop and evaluate new aftercut flavors based on methyl jasmonate - second quarter, 1990.

(3) Optimize the level of lactic acid on the wrapper, and investigate the use of other organic acids including levulinic acid, malic acid, malonic acid, and tartaric acid - first quarter, 1990.

(4) Investigate the use of additives on the wrapper which will "chemically scrub" aldehydes, such as a cooked flavor type system and a β-amino alcohol as well as filters containing these materials - second quarter, 1990.

(5) Conduct study to determine optimum filler packing density - second quarter, 1990.

(6) Conduct preliminary machinability testing of the high basis weight wrapper to identify sideseam adhesives and processing conditions for high spped cigarette manufacture - second quarter, 1990.

(7) POL test most promising model - second quarter, 1990.

(8) Develop high basis weight papers for use on Japanese products - second quarter, 1990.

(9) Investigate the effect of Ambrosia additives on cigarettes made with high basis weight papers - second quarter, 1990.

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(10) Evaluate promising sizing agents on calcium carbonate papers for analytical smoking and subjective performance - continuing.

2. Investigate and develop alternate inorganic fillers

a. Status

Research into development of alternate inorganic fillers for sidestream reduction can be divided into four general areas. The first is the synthesis of inorganic oxides/carbonates through the sol-gel process. This method was selected for investigation since it can be controlled so that very small, high surface area particles with potentially novel morphologies are produced. Initial results obtained during the latter part of the fourth quarter, 1989, indicated that a novel composition of matter, comprised of hydromagnesite [$Mg_5(CO_3)_4(OH)_2$ 4-$5H_2O$] and magnesium hydroxide in an intimate mixture, led to excellent sidestream reduction in a cigarette which had acceptable subjective properties and excellent ash formation. A number of sol-gel routes have subsequently been employed to prepare compositions having hydromagnesite and/or magnesium hydroxide with a goal of developing a proprietary inorganic filler having the properties described above. It is important to note that there are no reports in the literature regarding gels from magnesium carbonates. Hence, patent protection should be available not only for processes, but for compositions of matter.

We are currently pursuing our immediate objective; namely, to reproduce the initial studies. We are also examining all possible sol-gel routes to materials having these magnesium carbonate/magnesium hydroxide compositions with a goal of developing a procedure which can be performed on a commercial scale. By careful examination of the phase diagrams involved and evaluating the role of kinetic control vs. thermodynamic control, we plan to achieve these objectives.

The sol-gel approach is now only one of a number of approaches to the development of new inorganic fillers for sidestream reduction. We are taking the best leads from our sol-gel research and attempting to prepare identical and/or related compositions using other procedures. Thus, the second approach is the synthesis and evaluation of inorganic compounds with chemical properties significantly different from calcium carbonate or brucite (magnesium hydroxide). Promising results have been obtained for hydromagnesite and magnesite. Most of the effort during the first quarter will be placed on various phases of magnesium carbonate. We will be investigating different routes for the synthesis of hydromagnesite/magnesium hydroxide/magnesite compositions. If requested , we will prepare additional quantities of

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magnesite by hydrothermal methods (see below) for larger-scale testing.

The third approach is the use of alternate techniques for the synthesis of inorganic materials in order to determine how the method of synthesis alters chemical composition and physical properties. Techniques which will be used are hydrothermal synthesis and spray/flow pyrolysis. Hydrothermal techniques have been used to prepare magnesite, a pure magnesium carbonate which has been shown to be a fine sidestream reductant. Another technique which is being used, although not truly a technique for synthesis, is sonication. Sonication can break up agglomerates of solids, initiate nucleation, and/or reduce particle size. Consequently, certain materials may function more effectively to reduce sidestream. Freeze drying has now been found to effectively produce materials which lead to more porous paper.

The fourth approach is the direct modification of paper or of substances, e.g., flax, which are used to make paper. For example, one of the important leads from our sol-gel studies is that compositions of magnesium hydroxide and hydromagnesite significantly reduce sidestream visibility. Since we have been able to convert magnesium hydroxide to hydromagnesite in the presence of carbon dioxide, we anticipate that we could form intimate mixtures of these two substances by treating paper containing magnesium hydroxide with carbon dioxide.

Studies have been designed to determine why certain inorganic fillers are effective while others are not. Previous hypotheses which have addressed this question, namely, the role of filler surface area and the requirement that the filler undergo some type of reaction or phase change, have not proven out. Recently, the hypothesis that there is an interaction between the inorganic filler and the fluxing agent to form a ceramic has been advanced. Although our original thought was that this interaction may have involved sintering, further investigations indicate that the key step may be liquifaction of the fluxing agent. This hypothesis will be investigated further with the ultimate goal of developing a rapid screening method for the identification of promising new inorganic fillers or fluxing agents.

b. Tactics and Timetable

(1) Sol-Gels

(a) Pursue synthesis of sol-gel derived mag carbonate through the second quarter of 1990 using both aqueous and no-aqueous systems. Approaches will be concentrated on hydrolysis of methyl

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magnesium carbonate and carbonation and precipitation of hydromagnesite - second quarter, 1990.

(b) Evaluate papers made using these particles - continuing.

(c) Fully characterize chemical/physical structures of sol-gels already obtained including X-ray diffraction, Raman spectroscopy, infrared spectroscopy and TGA - continuing.

(f) Develop analytical techniques, such as small angle scattering and light scattering, to determine the size and shape of the developing polymer during the sol to gel transition - continuing.

(2) Other inorganic fillers

(a) Fully evaluate hydrothermal synthesis to obtain novel inorganic filler compositions starting with combinations of hydromagnesite, magnesium oxide, magnesium hydroxide, and/or magnesite in the presence of water and carbon dioxide - first quarter, 1990.

(b) Treat paper, flax, and other paper precursors, which have been previously treated with magnesium hydroxide, with carbon dioxide to partially react the magnesium hydroxide - third quarter, 1990.

(c) Continue joint development program with Ecusta on magnesite papers - continuing.

(d) Locate a commercial source for coprecipitated magnesium hydroxide/calcium carbonate or calcium carbonate precipitated on fine magnesium hydroxide particles - second quarter, 1990.

(e) Synthesize, characterize, and evaluate compounds selected - continuing.

(f) Investigate catalytic systems - continuing.

(3) Alternate methods of synthesis

(a) Investigate the feasibility of spray pyrolysis or flow pyrolysis as a technique for the preparation of inorganic fillers for low sidestream papers, with an emphasis on magnesium compounds - third quarter, 1990.

(b) Investigate the effect of sonication and freeze drying on performance of a number of

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inorganic fillers with respect to sidestream reduction - continuing.

3. Investigate and develop alternate fluxing agents

a. Status

The November, 1989, plan discussed the role of the fluxing agent for calcium carbonate papers. To summarize: 1) a calcium carbonate low sidestream paper requires the presence of an alkali metal salt to achieve significant sidestream reduction; 2) the role of the fluxing agent is most likely to form a "ceramic sheath" by first melting and then solidifying; 3) as long as the fluxing agent is a low-melting solid, the sidestream reduction obtained will be solely a function of the potassium level - the nature of the anion plays no role. As a consequence of the latter fact, there was little likelihood of improving on mono potassium phosphate as a fluxing agent with respect to sidestream reduction. The situation with magnesium carbonate papers, however, is quite different.

Extremely interesting results have been obtained with magnesium carbonate papers using potassium citrate and potassium succinate as fluxing agents. Magnesite papers give improved sidestream reduction with potassium citrate as opposed to potassium succinate at basis weights over 45 g/m^2. The situation is reversed for hydromagnesite, where potassium citrate is virtually ineffective, but potassium succinate works quite well. Sodium salts appear to be fore effective than potassium salts at equal molar levels for hydromagnesite papers. Sodium fumarate appears to be particularly interesting. At this time we have no explanation for these findings; however, these results clearly point out the importance of evaluating a given phase of magnesium carbonate with a series of fluxing agents. Studies are in progress to examine both magnesite and hydromagnesite papers with a series of fluxing agents at a range of levels. In addition, certain of these papers will be analyzed by electron microscopy both before and after burning. Plans for further work in this area cannot be formulated until the results from the studies proposed above have been obtained.

b. Tactics and Timetable

(1) Evaluate sidestream reduction with a variety of magnesium carbonate phases at a range of levels of the following alkali metal salts: potassium succinate, potassium citrate, sodium fumarate and other sodium salts, and potassium and sodium pyrophosphates - second quarter, 1990.

(2) Investigate the use of various sugars which are either already acidic or potentially could generate

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acidic products during combustion - second quarter, 1990.

(3) Complete screen of soluble iron compounds as potential fluxing agents - first quarter, 1990.

(4) Investigate the use of soluble calcium and magnesium compounds, particularly magnesium polyphosphates and soluble $Mg(H_2PO_4)_2$, as potential fluxing agents - second quarter, 1990.

4. Carry out fundamental studies to determine the mechanism by which low sidestream papers reduce sidestream visibility

a. Status

At this time only three types of mechanisms can be proposed to account for the reduction in visible sidestream smoke through the use of low sidestream cigarette papers. The first is that the particle size of the smoke is decreased so that light scattering properties change. If this were to occur, then the visibility would appear to decrease even though there may be little or no change in actual particulate matter. We have sufficient evidence at this time to indicate that this mechanism is not operative for the systems examined to date (calcium carbonate and magnesium hydroxide wrappers). First of all light scattering data has shown that there is no difference in the mean particle size or standard deviation for sidestream smoke from models made with either calcium carbonate or magnesium hydroxide compared to a normal cigarette. This finding will be independently confirmed using the sidestream chamber (see below). Secondly, in every case checked there is an excellent correlation between weight of sidestream particulate matter and visibility measurements.

The second mechanism postulates that the low sidestream wrapper forms a "ceramic sheath" (see above) around the coal which either forces the sidestream smoke down the rod, leading to increased mainstream TPM, or forces the smoke through the coal, resulting in increased sidestream gas phase. A study was carried out in 1989 wherein a mixture of ^{14}C-glucose and fructose was added to a full circumference calcium carbonate dual wrap cigarette and a single wrap magnesium hydroxide cigarette. The results indicated that the mechanism of sidestream reduction for the calcium carbonate model was quite consistent with the "ceramic sheath" hypothesis. However, the mechanism for the magnesium hydroxide model was different. It is likely that the mechanism for magnesium carbonate wrappers is similar to that for magnesium hydroxide.

The last mechanism suggests that the combination of inorganic filler and "fluxing agent" is converting sidestream smoke at the char line to volatile components. This

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conversion could either be oxidative in nature (combustion to carbon dioxide and carbon monoxide) or pyrolytic (cracking of high molecular weight compounds to low molecular weight compounds). Since magnesium carbonate filled paper does not seem to be operating via a "ceramic sheath" type mechanism, it is likely that this mechanism is extremely important for magnesium carbonate papers. Therefore, it is in this area that most of the effort on elucidating mechanisms of sidestream reduction must be placed in the short term.

Longer term mechanistic work will examine in more detail the physical differences in the static burning of low sidestream models as compared to normal models. Specific areas include studies of thermal properties of the coal using both the IR camera and Schlieren photography, and neutron radiographic studies.

Work is continuing to determine if the previously observed increase in the surface area of paper chars is related to sidestream smoke reduction. Examinations are focusing on the effect of heat on the individual surface areas of the calcium carbonate and flax portions of cigarette paper, as well as the effect of selected sizing agents on the paper components. Preliminary work has involved the development of improved methods for heating samples and conducting the analyses. Results to date suggest that the interaction of the sizing agent with calcium carbonate upon heating is probably not the source of the increase in surface area. Investigation of cellulose/flax samples is currently in progress.

A study is in progress in collaboration with the University of Virginia Nuclear Engineering Department using neutron activation to examine the SS/MS smoke distribution of phosphorus from a low sidestream model cigarette made utilizing a high basis weight calcium carbonate paper sized with 11-12% mono potassium phosphate. The sidestream smoke from this cigarette model is somewhat irritating, and the cause may be due to phosphorus-containing compounds derived from the phosphate additive on the paper. The study involves neutron activation of empty cigarette paper tubes (and filters), insertion of a preformed roll of tobacco, followed by smoking and analysis of ^{32}P on sidestream and mainstream TPM pads. Preliminary work has shown that the technique has the sensitivity needed for the model of interest. Knowing the transfer rate of phosphorus to the smoke streams may help us understand the source of the irritancy of the sidestream smoke.

Research studies will be initiated at the Solar Energy Research Institute (SERI) on the pyrolysis products of cigarette paper, in collaboration with Dr. Helena Chum. In particular a Box-Behnken design will be conducted to evaluate the effects of pH, temperature, and additive concentration on

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the pyrolysis products of the paper. Multivariate analysis will be used for data reduction of the mass-spectral patterns obtained from the triple quadrupole mass spectrometer at SERI. These statistical techniques are well-suited for evaluating complex systems in which many variables are exerting an effect simultaneously. They are also ideally suited for evaluating complex product distributions from biomaterials such as cellulose or tobacco. Additionally, definitive mechanistic studies will be conducted using Acetobacter xylinum from ^{13}C-labelled glucose substrates. These studies will provide unambiguous information regarding the effect of acids and bases on pyrolysis mechanisms and products.

b. **Tactics and timetable**

(1) Carry out neutron radiography studies to examine the SS/MS smoke distribution of phosphorus from a low sidestream model cigarette utilizing a high basis weight paper sized with mono potassium phosphate - first quarter, 1990.

(2) Examine the effects of different flax/cellulose refining conditions on the surface area of paper chars - second quarter, 1990.

(3) Initiate research at SERI on the pyrolysis products of cigarette paper as a function of pH, temperature, and additive concentration - first quarter, 1990.

(4) Investigate the possible correlation of the pH of mainstream smoke with the subjective characteristics of low sidestream cigarettes - second quarter, 1990.

(5) Choose three or four "marker compounds" in sidestream TPM, obtain compounds labelled with ^{14}C, add to tobacco, make cigarettes, and determine fate of label in low sidestream and standard models - long term study (one to three years).

(6) Carry out neutron radiography studies of both low sidestream and normal models in order to generate tomographic reconstruction of the coal - fourth quarter, 1990.

5. **Develop and optimize products using experimental papers**

a. **Status**

When cigarettes made with an experimental paper show product potential in terms of sidestream reduction and analytical smoking results, and these results have been demonstrated on machine-made cigarettes, the cigarettes are evaluated subjectively to further assess product potential.

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Typically, the cigarettes are found lacking in one or more subjective attribute, and work is undertaken to improve subjective performance while maintaining the sidestream reduction. Through the combined efforts of Cigarette Technology, Cigarette Development, Flavor Development, and the Leaf Department, models with modified papers, blends, flavors, and constructions are fabricated and evaluated. Attention is also given to developing a commercial source of the paper so that a market introduction could be implemented rapidly if warranted.

Currently all of the effort directed toward this strategy involves the optimization of high basis weight calcium carbonate papers. Most of the tactics have already been covered under strategy number 1. There are three specific areas, however, which will be covered here; namely, 1) investigation of mixtures of mono sodium and mono potassium phosphate as the fluxing agent for high basis weight papers; 2) support of Japan Cigarette Development's efforts to develop a low sidestream product for the Japanese market; and 3) work directed toward a model with an intermediate sidestream reduction (about 40-50%)

For the 63 g/m^2 calcium carbonate papers, mono potassium phosphate has been an effective sizing agent with respect to sidestream reduction. However, the use of high levels of this sizing agent may cause problems in the commercial development of a paper, since the solubility of mono potassium phosphate in water is low enough to cause problems. Mono sodium phosphate is much more soluble. Consequently, if a mixture of the two salts were used, commercial paper production would be straightforward. Mixtures of mono sodium and mono potassium phosphate have been tested and can achieve the sidestream reduction and puff count targets. Subjective screening is being conducted for the mixed salts. If models with the mixed salts are subjectively acceptable, then we will respecify the composition of the paper.

Models have been made with four Kimberly-Clark high basis weight papers (E2557-E2560), two blends (Lark and L&M), and charcoal filters. Although the E2560 paper was preferred for these models, as was the case with Project Lotus models, it has been decided to do further work with the E2559 paper (63 g/m^2 basis weight, 36% calcium carbonate, and 2.9 Coresta porosity) so that maximal sidestream reduction is achieved. Paper has been ordered with the appropriate level of mono potassium phosphate to make sufficient cigarettes for a Danchi test. In addition work will be continued to determine the explanation for the low visible sidestream levels for JTI cigarettes.

Cigarettes were made with 6-8% mono potassium phosphate on E2560 paper to achieve a 40-50% reduction in sidestream visibility in an attempt to realize better subjective

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performance at this intermediate level of visibility reduction. Subjective testing did not show significantly better performance at 45% reduction compared to models with 65% sidestream visibility reduction. Work with the high basis weight paper at intermediate visibility levels has been discontinued at this time.

b. Tactics and timetable

(1) Evaluate mixtures of mono sodium and mono potassium phosphate sizing agents with the preferred blend - second quarter, 1989.

(2) Provide appropriate papers for cigarettes for a second quarter Danchi test of a low sidestream prototype - first quarter, 1990.

(3) Evaluate hand-made single component cigarettes made from eight Japanese tobacco grades for sidestream production and static burn time - second quarter, 1989.

6. **Characterize the chemistry of sidestream smoke from existing brands, new products and prototypes using the new sidestream chamber**

a. Status

A system for determining total particle number and particle size distribution has been added to the sidestream chamber. A transmissometer, a device which can obtain visibility data, has also been added. The ammonia analysis is now a routine method, and the capability for aldehyde analysis (formaldehyde, acetaldehyde, and propionaldehyde) has been added. A nicotine study has been completed which has resulted in the construction of a decay curve. An equation to describe this decay curve is now being developed. Also, the study has shown that XAD collection of nicotine is superior to the use of Extralut. A study of the sidestream chemistry of high basis weight papers is now in progress.

Discussions are in progress to evaluate the potential use of the sidestream chamber to support Project Ambrosia. A decision should be reached by the end of February.

b. Tactics and timetable

(1) Complete study on models made from high basis weight papers - first quarter, 1990.

(2) Continue method development work using both the Chemical Research and Analytical Research chambers - continuing.

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(3) Develop capability to monitor mainstream carbon monoxide, carbon dioxide, and TPM using the sidestream chamber while simultaneously measuring sidestream components - first quarter, 1990.

(4) Determine potential role of the sidestream chamber to support Project Ambrosia - March, 1990.

7. **Define the subjective and analytical characteristics of mainstream smoke from a calcium carbonate, dual wrap low sidestream prototype compared to an appropriate control**

a. **Status**

Although the primary objective of the low sidestream portion of the paper technology program is the development of a proprietary paper which will reduce visible sidestream smoke, it is of considerable importance to understand what changes in mainstream smoke have occurred in commercial low sidestream papers in order to appropriately design new low sidestream models for acceptable subjectives. Neither the Kimberly-Clark low sidestream calcium carbonate paper or the Ecusta magnesium hydroxide paper give acceptable subjectives on a full circumference cigarette. Models utilizing the KC paper tend to have a "dirty" off taste, whereas the Ecusta papers, and many other papers using magnesium compounds, are characterized by a harsh, metallic taste. Three sets of cigarettes have been made, each set containing a model with Marlboro blend and a model with 2I blend. The three sets are a control made with standard paper, an experimental model made with Ecusta 35% magnesium hydroxide paper, and an experimental model made with the double wrap system (KC 093 outer liner and PDM inner liner). Initial subjective screening confirmed that gross subjective differences among the models were present. The second phase of the work, detailed subjective analysis and basic analytical characterization of the mainstream smoke from each model, has also been completed except for a small number of analytical determinations. When the second phase has been completed, phase three, fractionation of gas phase or particulate into specific chemical classes, will be initiated. This work will start with a determination of a mainstream gas phase profile, separation of condensate into acid, base, and neutral fractions, and detailed gc/ms analysis of the acid and basic fractions.

b. **Tactics and timetable**

(1) Complete analytical evaluation of main stream smoke from both models and control - first quarter, 1990.

(2) Initiate detailed analytical study of mainstream smoke - second quarter, 1990.

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III. Products for Aroma Modification of Sidestream

A. Objective

To develop a wrapper containing a vanillin-release agent.

B. Introduction and Status

In order to support Project Ambrosia regarding developing a paper containing a vanillin-release agent, it was necessary to prepare a proprietary material to avoid potential infringement with the Ecusta patent covering "flavor-release sugar glycosides." Such a compound was prepared through the base-catalyzed condensation of vanillin with ethyl phenylacetate (CR-2898). Subjective evaluation of cigarettes made from paper coated with this compound confirmed that the compound fulfilled the necessary requirements for a Chelsea "look alike." A three step synthesis of this material was developed, and the Aldrich Chemical Company was contacted in order to make sufficient material for test market. Work at Aldrich is in progress. During product development work with papers coated with this compound, it was noted that the material was photosensitive. The papers yellowed, particularly when subjected to light from a mercury vapor lamp. Although this complication was not expected, it was not surprising. Free phenols are known to undergo light catalyzed reactions, particularly under basic conditions. Apparently, the calcium carbonate filler in the cigarette paper is sufficiently basic. Further work has shown that with sufficient irradiation (two weeks in the slitter room under mercury vapor lamps) the compound is converted in about 80% yield to essentially a single yellow compound. Currently our challenge is two-fold - 1) to have sufficient amount of a vanillin-release agent in hand by the end of March for a potential test market, and 2) to redesign the compound to eliminate its photosensitivity. The following strategies have been developed to meet this challenge.

1. Prepare sufficient quantities of material at Aldrich to meet test market requirements.

2. Determine the extent of the "yellowing" problem.

3. Develop an alternate vanillin-release agent which will not undergo photosensitized reaction.

C. Tactics and Timetable

1. Prepare sufficient quantities of material at Aldrich to meet test market requirements.

a. A schedule has been worked at with Aldrich which calls for delivery of 6.5 pounds of CR-2898 in early March and an additional 25 pounds by March 22.

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b. Carry out detailed smoke chemistry studies to allow phase four clearance - March 15, 1990.

c. Conduct paper coating trials with Ecusta to ensure that there will be no problems in coating test market quantities - March 15, 1990.

2. **Determine the extent of the "yellowing" problem.**

a. Determine the extent of photochemical conversion as a function of time for various light sources including mercury vapor, metal halide, fluorescent, and sunlight - March 2, 1990.

b. Identify the compound formed in the photochemical conversion - second quarter, 1990.

3. **Develop an alternate vanillin-release agent which will not undergo photosensitized reaction.**

a. Block the vanillin hydroxyl group of CR-2898 with t-butyl carbonate and evaluate product subjectively - March 2, 1990.

b. Optimize synthesis for blocked CR-2898 - April 1, 1990.

c. Carry out detailed pyrolysis/gc/ms studies on blocked CR-2898 - April 15, 1990.

d. Prepare sufficient blocked CR-2989 for run of machine-made cigarettes - May 1, 1990.

e. Contract out synthesis of large quantities of blocked CR-2898 if required.

IV. Project Tomorrow

A. Objective

To develop special cigarette papers which will control the burn rate of a cigarette.

B. Introduction and Status

Work to date has shown that the burn rate of a cigarette can be retarded if some type of process is performed which results in bands of lower porosity on the cigarette paper. A paper of this type may have utility for Project Tomorrow. Two types of treatments are currently being investigated. The first involves treatment of normal cigarette paper with bands using either the gel phase of metal oxides or carbonates prepared by the sol-gel process or soluble phosphate burn retardants. Models made by hand-painting of sol-gel derived alumina gel gives a cigarette

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which burns more slowly in the treated area. A number of attempts have been made to coat paper with bands of two different sol-gels - the alumina sol-gel prepared at Lee Labs, and a magnesium hydroxide gel containing 3% alumina prepared at NY Poly. To date we have been unable to apply sufficient material using a rotogravure press to see any effect on mass burn rate. Similar problems have been encountered with both mono potassium and mono sodium phosphate. We are currently working to achieve an overall coating with the rotogravure press in order to compare mass burn rates of fully coated papers and banded papers at similar loading per unit area of paper. Problems have been encountered, however, in coating 25 g/m^2 basis weight papers caused by the low concentration of the solutions being used. It would appear at this time that the only viable material that can be used for this approach is mono sodium phosphate.

A second approach is to introduce bands of increased flax density where the additional flax contains no inorganic filler on the paper maker. Hand sheets have been made utilizing this approach, and results have been encouraging. However, at this time no method exists which would allow us to make paper with bands of this type commercially. A modified dandy roll has been designed which would allow the application of transverse bands of flax, or other fibers, on the Fourdrinier wire. Detailed drawings of parts is now in progress. When all necessary parts have been obtained, the apparatus will be installed on the pilot paper maker at the University of Maine.

The two strategies currently being pursued for Project Tomorrow are:

1. Prepare bobbins of paper for Project Tomorrow with transverse bands of mono sodium phosphate on the paper.

2. Develop potential methodology for applying dense flax bands to cigarette paper at the paper-making machine.

C. Tactics and Timetable

1. Prepare bobbins of paper for Project Tomorrow with transverse bands of mono sodium phosphate on the paper.

a. Overall coat standard cigarette paper with a highly concentrated solution of mono sodium phosphate at two levels achieved by one and two passes on a rotogravure press - second quarter, 1990.

b. Apply transverse bands of mono sodium phosphate at the same levels as in (a) using a rotogravure press - second quarter, 1990.

c. Compare burn rate of cigarettes made from papers produced in (a) and (b) - second quarter, 1990.

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2. **Develop potential methodology for applying dense flax bands to cigarette paper at the paper-making machine.**

a. Complete detailed drawings, and ordering and machining of parts for modified dandy roll - March 7, 1990.

b. Build modified dandy roll on to University of Maine pilot paper making machine - March 21, 1990.

c. Carry out trials at University of Maine for the production of bobbins of paper containing transverse flax bands - second quarter, 1990.

V. PM Web

A. Objective

To support the Filter Research and Development Program through the development of a CA web type material by the third quarter of 1990.

B. Introduction and Status

Paper filters have been shown to have a greater filter efficiency as compared to CA tow at equal filter RTDs. However, paper filters suffer from a subjective disadvantage compared to CA. Some time ago Celanese sampled us with a filter material they call CA web. This material is manufactured through a paper making process. A proprietary material Celanese calls fibrets enables a sheet to be made on a Fourdrinier wire. CA web is an extremely interesting material in that it appears to have the same filtration properties as paper, but the subjective response of CA. Unfortunately it appears that it will be at least two years, if not longer, before CA web can be commercialized. As a consequence the Paper Technology group has been asked to assist the Filter Research and Development group in the development of an alternative to CA web.

Three approaches are currently being investigated. The first involves the formation of PM web. This material is made from 75% cut (1/4") CA staple and 25% softwood fiber. The softwood fiber provides sufficient hydrogen bonding to allow a paper web to be formed on a Fourdrinier wire. Considerable work has been done in the hand sheet lab with this material, and several bobbins, varying only in the extent of softwood fiber refining, have recently been made at the University of Maine.

The second approach will investigate coating of paper filter web with both cellulose acetate and triacetin. Arrangements have been made at the James River Paper Company to coat the filter paper with acetone solutions of both materials. In order to move as rapidly as possible on this approach, we will use the most appropriate rotogravure cylinder James River has available which will provide only 80% coverage. If results are promising, we will have a ten inch cylinder made, and repeat the work on a larger scale.

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The third approach is still in the research stage and would appear difficult to commercialize to date. This approach involves acetylation of the paper surface. Promising results have been obtained using acetic anhydride and potassium carbonate as the acetylation medium in the laboratory. However, the time required to achieve the desired degree of surface acetylation, two hours, is far too long to allow for a commercial process to be developed. An initial trial with a much more active catalyst, sulfoacetic acid, led to disintegration of the paper. Although work on this approach will continue for the present, it will be terminated if results from the coating trials are sufficiently encouraging.

As can be seen, the three strategies being employed to achieve the stated objective are:

1. Utilize paper making technology to form a filter material consisting of an appropriate mixture of CA and cellulose fiber.

2. Coat filter paper web with CA and/or triacetin to form a filter material with filtration properties similar to paper and subjective properties similar to CA.

3. Develop a technique for surface acetylation of filter paper web which can be commercialized.

C. **Tactics and Timetable**

1. Utilize paper making technology to form a filter material consisting of an appropriate mixture of CA and cellulose fiber.

a. Evaluate filters made from PM web at the University of Maine - second quarter, 1990.

b. Utilize information gained from (a) above to optimize PM web at the University of Maine - second quarter, 1990.

2. Coat filter paper web with CA and/or triacetin to form a filter material with filtration properties similar to paper and subjective properties similar to CA.

a. Coat filter paper web with acetone solutions of CA and triacetin at James River - February 19, 1990.

b. Evaluate filters made from coated papers - second quarter, 1990.

c. If results from (b) above are promising, fabricate ten inch rotogravure cylinder and coat papers with a range of concentrations of CA and/or triacetin - second quarter, 1990.

3. Develop a technique for surface acetylation of filter paper web which can be commercialized.

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a. Continue experiments with sulfoacetic acid - second quarter, 1990.

b. Investigate other catalysts and solvents for acetylation reaction - second quarter, 1990.

c. Contact recommended paper manufacturers to discuss potential commercialization of such a process - second quarter, 1990.

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Appendix A

It is anticipated at this time that the majority of the effort for the Paper Technology Program after 1990 will be in the area of reduced sidestream and Project Tomorrow. However, it is also anticipated that much of the effort devoted to the reduced sidestream program will shift to the second objective; namely, the development of papers which can reduce sidestream odor and irritation. During the next six months a plan will be developed to address this issue. This plan will involve the following strategies:

1. Identify chemical classes of compounds which are responsible for sidestream odor and irritation.

2. Investigate the effect of known catalysts incorporated into the wrapper on sidestream odor and irritation.

3. Investigate the effect of substances which are known to react with aldehydes, amines, and sulfur compounds on sidestream odor and irritation when incorporated into the wrapper.

4. Establish an objective method for determining sidestream irritation.

5. Rank blend components using single component cigarettes with regard to sidestream odor and irritation.

6. Collaborate closely with personnel in Project Ambrosia regarding the effects of specific flavorants on sidestream odor.

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Paper Technology/Reduced Sidestream Plan

February 15, 1990

I. Introduction

The paper technology program has as its overall objective the development of proprietary cigarette papers for new products. The specific applications at this time are: 1) products with reduced sidestream visibility; 2) products for aroma modification of sidestream; 3) papers which will allow control of burn rate for Project Tomorrow; 4) development of filter materials which can be used to make filters with surface areas equivalent to paper filters, but with surface adsorption characteristics similar to cellulose acetate At this time the first goal, cigarettes with reduced sidestream visibility, is by far the highest priority. Consequently the majority of this plan will be devoted to that topic. Plans regarding the remaining three topics are restricted to the specific areas involving the development of new papers.

II. Products with Reduced Sidestream Visibility

A. Objectives

1. To develop a proprietary cigarette wrapper which will reduce visible sidestream smoke by at least 70% in a full circumference cigarette, as compared to an appropriate control, with acceptable subjectives by 1990.

2. To develop proprietary cigarette wrappers which will in addition to reducing sidestream visibility will reduce sidestream odor and irritation.

The second objective has been added in 1990. Little work is planned to take place addressing this objective in 1990. It is anticipated, however, that by the end of 1990 several satisfactory prototypes with reduced visibility will have been completed. Resources will then be phased into development of products with reduced odor and irritation. A brief outline of the plans for this phase of the project for 1991 and following years is given in Appendix A.

B. Introduction and Status

Philip Morris has been working on cigarettes with reduced sidestream visibility for about eight years. Work was initiated with the introduction of a commercial reduced sidestream brand, Passport, in Canada, and has grown in importance during the intervening years as a consequence of the public's growing, although misplaced, concern over passive smoke. Passport utilized a paper manufactured by Ecusta containing 12% magnesium hydroxide. The product had serious subjective problems and was not a commercial success. During the first five years that R&D has been involved in a reduced sidestream program we depended on our two suppliers, Ecusta and Kimberly-Clark, to provide us with low sidestream papers. Three years ago, however, a decision

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was made to attempt to develop our own low sidestream paper. This was done first of all because our suppliers have not been strikingly successful in providing us with a paper which will achieve our objectives. More importantly, however, is that it is essential that we develop our own proprietary paper to obtain a clear competitive advantage. In 1989 we developed a slim cigarette with sidestream reduction which met our target and acceptable subjectives. This product utilizes a double wrap system. The outer wrap was developed jointly by PM and Kimberly-Clark. It has a 45 g/m^2 basis weight, contains 35% calcium carbonate with a surface area of 20 m^2/g, and contains potassium succinate, monoammonium phosphate (MAP) and sodium carboxymethyl cellulose (CMC) as additives. The inner wrap is a thin (18 g/m^2) paper with 3% low surface area calcium carbonate and 2% potassium citrate. This product was introduced nationally in September, 1989, and appears to be doing reasonably well. Neither the system used on the slim cigarette nor the Ecusta magnesium hydroxide paper, however, has proved to be satisfactory for a full circumference cigarette. The best sidestream visibility reduction which has been achieved for a full circumference cigarette using the double wrap system is about 65%, below our target of 70%. In addition, there are clear taste problems. The magnesium hydroxide wrapper will give greater than 70% sidestream visibility reduction, but with severe subjective problems. Not only are there definite taste problems, but ash flaking problems as well. Despite the drawbacks of the magnesium hydroxide wrapper, RJR recently test marketed a low sidestream product, Vantage Excel. We regard this product to be unacceptable, and the product was withdrawn from test market in late 1989.

It can be concluded from the above discussion that the only way in which PM can successfully reach the goal of an acceptable full circumference product with greater than 70% sidestream visibility reduction is to design our own paper. In order to accomplish this goal we needed to develop certain resources to allow us to carry out research and development in the area of paper technology. In the past year we have built and equipped an in-house facility to fabricate hand sheets using flax fibers; we have negotiated a contract with the University of Maine to make pilot quantities of papers; we have developed an in-house inorganic chemistry group to investigate the chemistry of paper fillers; we have initiated work in the area of sol-gel chemistry to develop inorganic fillers with novel morphologies and surface charge, and have obtained consultants to assist us with this work; we have installed a sidestream chamber, similar to the facility at Neuchatel, to be able to carry out studies on sidestream smoke; we have designed and built an eight-port smoking apparatus to rapidly measure sidestream visibility; and we have put our two major paper suppliers on notice that we plan to conduct programs with them in a collaborative manner, so that we receive exclusivity on any papers which may result from such programs. In order to achieve the objective of developing a proprietary paper which will reduce sidestream visibility in a full circumference cigarette, we have delineated seven major strategies. These strategies are:

1. Develop "high basis weight" papers as low sidestream wrappers for full circumference cigarettes.

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2. Investigate and develop alternate inorganic fillers.

3. Investigate and develop alternate fluxing agents.

4. Carry out fundamental studies to determine the mechanism by which low sidestream papers reduce sidestream visibility.

5. Develop and optimize products using experimental papers.

6. Define the subjective and analytical characteristics of mainstream smoke from a calcium carbonate, dual wrap low sidestream prototype compared to an appropriate control.

7. Characterize the chemistry of sidestream smoke from existing brands, new products and prototypes using the new sidestream chamber.

An eighth strategy discussed in last year's plan - develop techniques for measuring visible sidestream smoke and sidestream particulates - is no longer included, since we have completed our work on this strategy.

Each of these strategies will be discussed below. A brief discussion of current status will be given followed by the specific tactics, along with target dates, which will be used to realize each strategy.

C. Strategies and Tactics

1. Develop "high basis weight" papers as low sidestream wrappers for full circumference cigarettes

a. Status

Development of a paper to yield a 65-70% reduction in sidestream visibility for a 24.8 mm circumference 100 mm cigarette has been the primary objective for this strategy during the past quarter. As was mentioned in the June, 1989, plan the original objective of this strategy was to determine if a dual wrap system could be replaced with a single wrap. Two types of wraps were investigated. One was a "bilayer" sheet made with a dual headbox system in such a way so that there was a difference in calcium carbonate levels between the inner and outer portions of the sheet. The second was a paper made to the same basis weight (63 g/m^2) as the bilayer sheet, but with a uniform distribution of the calcium carbonate. This latter sheet is called a "high basis weight" paper. The basis weight of 63 g/m^2 was chosen since it was the sum of the two wraps used for Trim V. Of the two types of paper, the high basis weight paper has given the more promising results. Considerable work with this paper has shown that to achieve significant sidestream reduction it is necessary to have a low porosity sheet (3-5 Coresta), a high concentration of potassium must be used, and a sufficient

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level of an appropriately chosen inorganic salt must be added to function as a burn retardant. The best results have been obtained by coating the paper with between 10 and 12% mono potassium phosphate. The potassium phosphate acts both as a source of potassium ion to provide good sidestream reduction and as a burn retardant. Although other potassium or sodium salts will give similar sidestream reductions, mono potassium phosphate has provided cigarettes with the best subjectives to date. A number of different models have been made, and sidestream reductions range from 65-68%.

An agreement has been signed by Kimberly-Clark giving PM exclusive use of this paper for a two year period. A patent covering this paper has also been filed. Kimberly-Clark has supplied us with 500 pounds of four papers with the following specifications: basis weight, 63 g/m^2; porosity, 2.9 and 4.2 Coresta; inorganic filler, Multifex MM calcium carbonate; level of inorganic filler, 26 and 36%. Cigarettes were made from these four papers using an amount of mono potassium phosphate calculated to give equal sidestream reduction. Based on subjective evaluation of these models, paper E2560 (4.2 Coresta, 36% calcium carbonate) has been selected for further work. Ongoing studies designed to optimize the subjective response of cigarettes made with this paper include screening of new blends, development of new aftercut flavors and casings, investigation of other additives on the wrappers to reduce sidestream irritability, optimization of packing density, and studies on the correlation of filler OV with subjective response.

New blend formulations have been developed by the Leaf Department in an effort to improve the tobacco character of the cigarette. Blend 218 gave improvements in subjective performance, but fell short of the sidestream reduction target. Blend 231 was formulated based on the 218 blend using more recon to reduce visible sidestream smoke. Testing of the 218 blend is in progress. An aftercut formulation containing methyl jasmonate was recommended by Flavor Development and is being tested on Marlboro blend, our standard reference blend. Initial sidestream panel testing indicates a significant difference in ratings for the methyl jasmonate aftercut. Further testing will tell whether the difference is in the direction of more tobacco character. Several materials have been added to the paper in order to reduce both sidestream irritability and mainstream "paper taste." These materials include sugars, MAP, MAP plus fructose, amino acids and lactic acid. Most promising have been the lactic acid samples. Further work is planned in this area.

One frequent response to cigarettes made with the high basis weight paper is 'dry taste.' To determine if the heavily sized paper extracts water from the tobacco, filler OV's were measured on packaged cigarettes with both

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conventional and 65 g/m^2 wrappers after 6 and 12 weeks of storage at laboratory conditions. No difference in filler OV was found between the two wrappers. Conventional and 65 g/m^2 papers were equilibrated at 60% relative humidity and tested for moisture content; both contained 6% OV. Lastly, cigarettes stored under two different types of conditions which differed by at least one OV unit were smoked subjectively. No major difference could be perceived between the two models. Therefore, the dry taste does not appear to be caused by an altered distribution of moisture in the cigarette. No further work will be done in this area except to determine an optimum OV level once a satisfactory model has been developed.

b. **Tactics and timetable**

(1) Complete investigation of different blends including Blend 231, Blend 213, and the L&M blend - first quarter, 1990.

(2) Continue to develop and evaluate new aftercut flavors based on methyl jasmonate - second quarter, 1989.

(3) Optimize the level of lactic acid on the wrapper, and investigate the use of other organic acids including levulinic acid, malic acid, malonic acid, and tartaric acid - fourth quarter, 1989.

(4) Investigate the use of additives on the wrapper which will "chemically scrub" aldehydes, such as a cooked flavor type system and a β-amino alcohol - second quarter, 1990.

(5) Develop potential casings containing lactic acid and other organic acids - second quarter, 1990.

(6) Conduct study to determine optimum filler packing density - second quarter, 1990.

(7) POL test most promising model - second quarter, 1990.

(8) Develop high basis weight papers for use on Japanese products - second quarter, 1990.

(9) Investigate the effect of Ambrosia additives on cigarettes made with high basis weight papers - second quarter, 1990.

(10) Evaluate promising sizing agents on calcium carbonate papers for analytical smoking and subjective performance - continuing.

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2. Investigate and develop alternate inorganic fillers

a. Status

Research into development of alternate inorganic fillers for sidestream reduction can be divided into four general areas. The first is the synthesis of inorganic oxides/carbonates through the sol-gel process. This method was selected for investigation since it can be controlled so that very small, high surface area particles with potentially novel morphologies are produced. Initial results obtained during the latter part of the fourth quarter, 1989, indicated that a novel composition of matter, comprised of hydromagnesite [$Mg_5(CO_3)_4(OH)_2$ 4-$5H_2O$] and magnesium hydroxide in an intimate mixture, led to excellent sidestream reduction in a cigarette which had acceptable subjective properties and excellent ash formation. A number of sol-gel routes have subsequently been employed to prepare compositions having hydromagnesite and/or magnesium hydroxide with a goal of developing a proprietary inorganic filler having the properties described above. It is important to note that there are no reports in the literature regarding gels from magnesium carbonates. Hence, patent protection should be available not only for processes, but for compositions of matter.

We are currently pursuing our immediate objective; namely, to reproduce the initial studies. We are also examining all possible sol-gel routes to materials having these magnesium carbonate/magnesium hydroxide compositions with a goal of developing a procedure which can be performed on a commercial scale. By careful examination of the phase diagrams involved and evaluating the role of kinetic control vs. thermodynamic control, we plan to achieve these objectives.

The sol-gel approach is now only one of a number of approaches to the development of new inorganic fillers for sidestream reduction. We are taking the best leads from our sol-gel research and attempting to prepare identical and/or related compositions using other procedures. Thus, the second approach is the synthesis and evaluation of inorganic compounds with chemical properties significantly different from calcium carbonate or brucite (magnesium hydroxide). Promising results have been obtained for hydromagnesite and magnesite. Most of the effort during the first quarter will be placed on various phases of magnesium carbonate. We will be investigating different routes for the synthesis of hydromagnesite/magnesium hydroxide/magnesite compositions. If requested , we will prepare additional quantities of magnesite by hydrothermal methods (see below) for larger-scale testing.

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The third approach is the use of alternate techniques for the synthesis of inorganic materials in order to determine how the method of synthesis alters chemical composition and physical properties. Techniques which will be used are hydrothermal synthesis and spray/flow pyrolysis. Hydrothermal techniques have been used to prepare magnesite, a pure magnesium carbonate which has been shown to be a fine sidestream reductant. Another technique which is being used, although not truly a technique for synthesis, is sonication. Sonication can break up agglomerates of solids, initiate nucleation, and/or reduce particle size. Consequently, certain materials may function more effectively to reduce sidestream. Freeze drying has now been found to effectively produce materials which lead to more porous paper.

The fourth approach is the direct modification of paper or of substances, e.g., flax, which are used to make paper. For example, one of the important leads from our sol-gel studies is that compositions of magnesium hydroxide and hydromagnesite significantly reduce sidestream visibility. Since we have been able to convert magnesium hydroxide to hydromagnesite in the presence of carbon dioxide, we anticipate that we could form intimate mixtures of these two substances by treating paper containing magnesium hydroxide with carbon dioxide.

Studies have been designed to determine why certain inorganic fillers are effective while others are not. Previous hypotheses which have addressed this question, namely, the role of filler surface area and the requirement that the filler undergo some type of reaction or phase change, have not proven out. Recently, the hypothesis that there is an interaction between the inorganic filler and the fluxing agent to form a ceramic has been advanced. Although our original thought was that this interaction may have involved sintering, further investigations indicate that the key step may be liquifaction of the fluxing agent. This hypothesis will be investigated further with the ultimate goal of developing a rapid screening method for the identification of promising new inorganic fillers or fluxing agents.

b. Tactics and Timetable

(1) Sol-Gels

(a) Carry out lab scale-up of the most promising sol-gel derived mag carbonate particles to allow larger scale evaluations in reduced sidestream papers - first quarter, 1990.

(b) Determine the detailed chemical and physical structure of the material obtained in part (a) including particle morphology, particle size,

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surface charge, and crystallographic information - second quarter, 1990.

(c) Complete synthesis and evaluation of sol-gels involving magnesium hydroxide/magnesium oxide/ hydromagnesite in both water and alcohol;-determine optimum conditions for preparation of solids from at least two procedures - second quarter, 1990.

(d) Evaluate papers made using these particles - third quarter, 1990.

(e) Fully characterize chemical/physical structures of sol-gels already obtained including X-ray diffraction, Raman spectroscopy, infrared spectroscopy and TGA - continuing.

(f) Develop analytical techniques, such as small angle scattering and light scattering, to determine the size and shape of the developing polymer during the sol to gel transition - continuing.

(2) Other inorganic fillers

(a) Fully evaluate hydrothermal synthesis to obtain novel inorganic filler compositions starting with combinations of hydromagnesite, magnesium oxide, magnesium hydroxide, and/or magnesite in the presence of water and carbon dioxide - first quarter, 1990.

(b) Treat paper, flax, and other paper precursors, which have been previously treated with magnesium hydroxide, with carbon dioxide to partially react the magnesium hydroxide - second quarter, 1990.

(c) Continue joint development program with Ecusta on hydromagnesite/magnesite papers - continuing.

(d) Locate a commercial source for coprecipitated magnesium hydroxide/calcium carbonate or calcium carbonate precipitated on fine magnesium hydroxide particles - second quarter, 1990.

(e) Synthesize, characterize, and evaluate compounds selected - continuing.

(f) Investigate catalytic systems - continuing.

(3) Alternate methods of synthesis

(a) Investigate the interaction of the fluxing agent with the inorganic filler in order to develop

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a rapid screening system for new fillers or fluxing agents - second quarter, 1990.

(b) Investigate the feasibility of spray pyrolysis or flow pyrolysis as a technique for the preparation of inorganic fillers for low sidestream papers, with an emphasis on magnesium compounds - second quarter, 1990.

(c) Investigate the effect of sonication and freeze drying on performance of a number of inorganic fillers with respect to sidestream reduction - continuing.

3. Investigate and develop alternate fluxing agents

a. Status

The November, 1989, plan discussed the role of the fluxing agent for calcium carbonate papers. To summarize: 1) a calcium carbonate low sidestream paper requires the presence of an alkali metal salt to achieve significant sidestream reduction; 2) the role of the fluxing agent is most likely to form a "ceramic sheath" by first melting and then solidifying; 3) as long as the fluxing agent is a low-melting solid, the sidestream reduction obtained will be solely a function of the potassium level - the nature of the anion plays no role. As a consequence of the latter fact, there was little likelihood of improving on mono potassium phosphate as a fluxing agent with respect to sidestream reduction. The situation with magnesium carbonate papers, however, is quite different.

Extremely interesting results have been obtained with magnesium carbonate papers using potassium citrate and potassium succinate as fluxing agents. Magnesite papers give improved sidestream reduction with potassium citrate as opposed to potassium succinate at basis weights over 45 g/m^2. The situation is reversed for hydromagnesite, where potassium citrate is virtually ineffective, but potassium succinate works quite well. Sodium salts appear to be fore effective than potassium salts at equal molar levels for hydromagnesite papers. Sodium fumarate appears to be particularly interesting. At this time we have no explanation for these findings; however, these results clearly point out the importance of evaluating a given phase of magnesium carbonate with a series of fluxing agents. Studies are in progress to examine both magnesite and hydromagnesite papers with a series of fluxing agents at a range of levels. In addition, certain of these papers will be analyzed by electron microscopy both before and after burning. Plans for further work in this area cannot be formulated until the results from the studies proposed above have been obtained.

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b. **Tactics and Timetable**

(1) Evaluate sidestream reduction with a variety of magnesium carbonate phases at a range of levels of the following alkali metal salts: potassium succinate, potassium citrate, sodium fumarate and other sodium salts, and potassium and sodium pyrophosphates - second quarter, 1990.

(2) Investigate the use of various sugars which are either already acidic or potentially could generate acidic products during combustion - second quarter, 1990.

(3) Complete screen of soluble iron compounds as potential fluxing agents - first quarter, 1990.

(4) Investigate the use of soluble calcium and magnesium compounds, particularly magnesium polyphosphates and soluble $Mg(H_2PO_4)_2$, as potential fluxing agents - second quarter, 1990.

4. Carry out fundamental studies to determine the mechanism by which low sidestream papers reduce sidestream visibility

a. **Status**

At this time only three types of mechanisms can be proposed to account for the reduction in visible sidestream smoke through the use of low sidestream cigarette papers. The first is that the particle size of the smoke is decreased so that light scattering properties change. If this were to occur, then the visibility would appear to decrease even though there may be little or no change in actual particulate matter. We have sufficient evidence at this time to indicate that this mechanism is not operative for the systems examined to date (calcium carbonate and magnesium hydroxide wrappers). First of all light scattering data has shown that there is no difference in the mean particle size or standard deviation for sidestream smoke from models made with either calcium carbonate or magnesium hydroxide compared to a normal cigarette. This finding will be independently confirmed using the sidestream chamber (see below). Secondly, in every case checked there is an excellent correlation between weight of sidestream particulate matter and visibility measurements.

The second mechanism postulates that the low sidestream wrapper forms a "ceramic sheath" (see above) around the coal which either forces the sidestream smoke down the rod, leading to increased mainstream TPM, or forces the smoke through the coal, resulting in increased sidestream gas phase. A study was carried out in 1989 wherein a mixture of ^{14}C-glucose and fructose was added to a full circumference calcium carbonate dual wrap cigarette and a single wrap

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magnesium hydroxide cigarette. The results indicated that the mechanism of sidestream reduction for the calcium carbonate model was quite consistent with the "ceramic sheath" hypothesis. However, the mechanism for the magnesium hydroxide model was different. It is likely that the mechanism for magnesium carbonate wrappers is similar to that for magnesium hydroxide.

The last mechanism suggests that the combination of inorganic filler and "fluxing agent" is converting sidestream smoke at the char line to volatile components. This conversion could either be oxidative in nature (combustion to carbon dioxide and carbon monoxide) or pyrolytic (cracking of high molecular weight compounds to low molecular weight compounds). Since magnesium carbonate filled paper does not seem to be operating via a "ceramic sheath" type mechanism, it is likely that this mechanism is extremely important for magnesium carbonate papers. Therefore, it is in this area that most of the effort on elucidating mechanisms of sidestream reduction must be placed in the short term.

Longer term mechanistic work will examine in more detail the physical differences in the static burning of low sidestream models as compared to normal models. Specific areas include studies of thermal properties of the coal using both the IR camera and Schlieren photography, and neutron radiographic studies.

Work is continuing to determine if the previously observed increase in the surface area of paper chars is related to sidestream smoke reduction. Examinations are focusing on the effect of heat on the individual surface areas of the calcium carbonate and flax portions of cigarette paper, as well as the effect of selected sizing agents on the paper components. Preliminary work has involved the development of improved methods for heating samples and conducting the analyses. Results to date suggest that the interaction of the sizing agent with calcium carbonate upon heating is probably not the source of the increase in surface area. Investigation of cellulose/flax samples is currently in progress.

A study is in progress in collaboration with the University of Virginia Nuclear Engineering Department using neutron activation to examine the SS/MS smoke distribution of phosphorus from a low sidestream model cigarette made utilizing a high basis weight calcium carbonate paper sized with 11-12% mono potassium phosphate. The sidestream smoke from this cigarette model is somewhat irritating, and the cause may be due to phosphorus-containing compounds derived from the phosphate additive on the paper. The study involves neutron activation of empty cigarette paper tubes (and filters), insertion of a preformed roll of tobacco, followed by smoking and analysis of ^{32}P on sidestream and mainstream

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TPM pads. Preliminary work has shown that the technique has the sensitivity needed for the model of interest. Knowing the transfer rate of phosphorus to the smoke streams may help us understand the source of the irritancy of the sidestream smoke.

Research studies will be initiated at the Solar Energy Research Institute (SERI) on the pyrolysis products of cigarette paper, in collaboration with Dr. Helena Chum. In particular a Box-Behnken design will be conducted to evaluate the effects of pH, temperature, and additive concentration on the pyrolysis products of the paper. Multivariate analysis will be used for data reduction of the mass-spectral patterns obtained from the triple quadrupole mass spectrometer at SERI. These statistical techniques are well-suited for evaluating complex systems in which many variables are exerting an effect simultaneously. They are also ideally suited for evaluating complex product distributions from biomaterials such as cellulose or tobacco. Additionally, definitive mechanistic studies will be conducted using Acetobacter xylinum from ^{13}C-labelled glucose substrates. These studies will provide unambiguous information regarding the effect of acids and bases on pyrolysis mechanisms and products.

b. **Tactics and timetable**

(1) Carry out neutron radiography studies to examine the SS/MS smoke distribution of phosphorus from a low sidestream model cigarette utilizing a high basis weight paper sized with mono potassium phosphate - first quarter, 1990.

(2) Examine the effects of different flax/cellulose refining conditions on the surface area of paper chars - second quarter, 1990.

(3) Initiate research at SERI on the pyrolysis products of cigarette paper as a function of pH, temperature, and additive concentration - first quarter, 1990.

(4) Investigate the possible correlation of the pH of mainstream smoke with the subjective characteristics of low sidestream cigarettes - second quarter, 1990.

(5) Choose three or four "marker compounds" in sidestream TPM, obtain compounds labelled with ^{14}C, add to tobacco, make cigarettes, and determine fate of label in low sidestream and standard models - long term study (one to three years).

(6) Carry out neutron radiography studies of both low sidestream and normal models in order to generate

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tomographic reconstruction of the coal - fourth quarter, 1990.

5. **Develop and optimize products using experimental papers**

a. Status

When cigarettes made with an experimental paper show product potential in terms of sidestream reduction and analytical smoking results, and these results have been demonstrated on machine-made cigarettes, the cigarettes are evaluated subjectively to further assess product potential. Typically, the cigarettes are found lacking in one or more subjective attribute, and work is undertaken to improve subjective performance while maintaining the sidestream reduction. Through the combined efforts of Cigarette Technology, Cigarette Development, Flavor Development, and the Leaf Department, models with modified papers, blends, flavors, and constructions are fabricated and evaluated. Attention is also given to developing a commercial source of the paper so that a market introduction could be implemented rapidly if warranted.

Currently all of the effort directed toward this strategy involves the optimization of high basis weight calcium carbonate papers. Most of the tactics have already been covered under strategy number 1. There are three specific areas, however, which will be covered here; namely, 1) investigation of mixtures of mono sodium and mono potassium phosphate as the fluxing agent for high basis weight papers; 2) support of Japan Cigarette Development's efforts to develop a low sidestream product for the Japanese market; and 3) work directed toward a model with an intermediate sidestream reduction (about 40-50%)

For the 63 g/m^2 calcium carbonate papers, mono potassium phosphate has been an effective sizing agent with respect to sidestream reduction. However, the use of high levels of this sizing agent may cause problems in the commercial development of a paper, since the solubility of mono potassium phosphate in water is low enough to cause problems. Mono sodium phosphate is much more soluble. Consequently, if a mixture of the two salts were used, commercial paper production would be straightforward. Mixtures of mono sodium and mono potassium phosphate have been tested and can achieve the sidestream reduction and puff count targets. Subjective screening is being conducted for the mixed salts. If models with the mixed salts are subjectively acceptable, then we will respecify the composition of the paper.

Models have been made with four Kimberly-Clark high basis weight papers (E2557-E2560), two blends (Lark and L&M), and charcoal filters. Although the E2560 paper was preferred for these models, as was the case with Project Lotus models,

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it has been decided to do further work with the E2559 paper (63 g/m^2 basis weight, 36% calcium carbonate, and 2.9 Coresta porosity) so that maximal sidestream reduction is achieved. Paper has been ordered with the appropriate level of mono potassium phosphate to make sufficient cigarettes for a Danchi test. In addition work will be continued to determine the explanation for the low visible sidestream levels for JTI cigarettes.

Cigarettes were made with 6-8% mono potassium phosphate on E2560 paper to achieve a 40-50% reduction in sidestream visibility in an attempt to realize better subjective performance at this intermediate level of visibility reduction. Subjective testing did not show significantly better performance at 45% reduction compared to models with 65% sidestream visibility reduction. Work with the high basis weight paper at intermediate visibility levels has been discontinued at this time.

b. Tactics and timetable

(1) Evaluate mixtures of mono sodium and mono potassium phosphate sizing agents with the preferred blend - second quarter, 1989.

(2) Provide appropriate papers for cigarettes for a second quarter Danchi test of a low sidestream prototype - first quarter, 1990.

(3) Evaluate hand-made single component cigarettes made from eight Japanese tobacco grades for sidestream production and static burn time - second quarter, 1989.

6. Characterize the chemistry of sidestream smoke from existing brands, new products and prototypes using the new sidestream chamber

a. Status

A system for determining total particle number and particle size distribution has been added to the sidestream chamber. A transmissometer, a device which can obtain visibility data, has also been added. The ammonia analysis is now a routine method, and the capability for aldehyde analysis (formaldehyde, acetaldehyde, and propionaldehyde) has been added. A nicotine study has been completed which has resulted in the construction of a decay curve. An equation to describe this decay curve is now being developed. Also, the study has shown that XAD collection of nicotine is superior to the use of Extralut. A study of the sidestream chemistry of high basis weight papers is now in progress.

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Discussions are in progress to evaluate the potential use of the sidestream chamber to support Project Ambrosia. A decision should be reached by the end of February.

b. **Tactics and timetable**

(1) Complete study on models made from high basis weight papers - first quarter, 1990.

(2) Continue method development work using both the Chemical Research and Analytical Research chambers - continuing.

(3) Develop capability to monitor mainstream carbon monoxide, carbon dioxide, and TPM using the sidestream chamber while simultaneously measuring sidestream components - first quarter, 1990.

(4) Determine potential role of the sidestream chamber to support Project Ambrosia - March, 1990.

7. **Define the subjective and analytical characteristics of mainstream smoke from a calcium carbonate, dual wrap low sidestream prototype compared to an appropriate control**

a. **Status**

Although the primary objective of the low sidestream portion of the paper technology program is the development of a proprietary paper which will reduce visible sidestream smoke, it is of considerable importance to understand what changes in mainstream smoke have occurred in commercial low sidestream papers in order to appropriately design new low sidestream models for acceptable subjectives. Neither the Kimberly-Clark low sidestream calcium carbonate paper or the Ecusta magnesium hydroxide paper give acceptable subjectives on a full circumference cigarette. Models utilizing the KC paper tend to have a "dirty" off taste, whereas the Ecusta papers, and many other papers using magnesium compounds, are characterized by a harsh, metallic taste. Three sets of cigarettes have been made, each set containing a model with Marlboro blend and a model with 2I blend. The three sets are a control made with standard paper, an experimental model made with Ecusta 35% magnesium hydroxide paper, and an experimental model made with the double wrap system (KC 093 outer liner and PDM inner liner). Initial subjective screening confirmed that gross subjective differences among the models were present. The second phase of the work, detailed subjective analysis and basic analytical characterization of the mainstream smoke from each model, has also been completed except for a small number of analytical determinations. When the second phase has been completed, phase three, fractionation of gas phase or particulate into specific chemical classes, will be initiated. This work will

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start with a determination of a mainstream gas phase profile, separation of condensate into acid, base, and neutral fractions, and detailed gc/ms analysis of the acid and basic fractions.

b. **Tactics and timetable**

(1) Complete analytical evaluation of main stream smoke from both models and control - first quarter, 1990.

(2) Initiate detailed analytical study of mainstream smoke - second quarter, 1990.

III. Products for Aroma Modification of Sidestream

A. Objective

To develop a wrapper containing a vanillin-release agent.

B. Introduction and Status

In order to support Project Ambrosia regarding developing a paper containing a vanillin-release agent, it was necessary to prepare a proprietary material to avoid potential infringement with the Ecusta patent covering "flavor-release sugar glycosides." Such a compound was prepared through the base-catalyzed condensation of vanillin with ethyl phenylacetate (CR-2898). Subjective evaluation of cigarettes made from paper coated with this compound confirmed that the compound fulfilled the necessary requirements for a Chelsea "look alike." A three step synthesis of this material was developed, and the Aldrich Chemical Company was contacted in order to make sufficient material for test market. Work at Aldrich is in progress. During product development work with papers coated with this compound, it was noted that the material was photosensitive. The papers yellowed, particularly when subjected to light from a mercury vapor lamp. Although this complication was not expected, it was not surprising. Free phenols are known to undergo light catalyzed reactions, particularly under basic conditions. Apparently, the calcium carbonate filler in the cigarette paper is sufficiently basic. Further work has shown that with sufficient irradiation (two weeks in the slitter room under mercury vapor lamps) the compound is converted in about 80% yield to essentially a single yellow compound. Currently our challenge is two-fold - 1) to have sufficient amount of a vanillin-release agent in hand by the end of March for a potential test market, and 2) to redesign the compound to eliminate its photosensitivity. The following strategies have been developed to meet this challenge.

1. Prepare sufficient quantities of material at Aldrich to meet test market requirements.

2. Determine the extent of the "yellowing" problem.

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3. Develop an alternate vanillin-release agent which will not undergo photosensitized reaction.

C. **Tactics and Timetable**

1. Prepare sufficient quantities of material at Aldrich to meet test market requirements.

a. A schedule has been worked at with Aldrich which calls for delivery of 6.5 pounds of CR-2898 in early March and an additional 25 pounds by March 22.

b. Carry out detailed smoke chemistry studies to allow phase four clearance - March 15, 1990.

c. Conduct paper coating trials with Ecusta to ensure that there will be no problems in coating test market quantities - March 15, 1990.

2. Determine the extent of the "yellowing" problem.

a. Determine the extent of photochemical conversion as a function of time for various light sources including mercury vapor, metal halide, fluorescent, and sunlight - March 2, 1990.

b. Identify the compound formed in the photochemical conversion - second quarter, 1990.

3. Develop an alternate vanillin-release agent which will not undergo photosensitized reaction.

a. Block the vanillin hydroxyl group of CR-2898 with t-butyl carbonate and evaluate product subjectively - March 2, 1990.

b. Optimize synthesis for blocked CR-2898 - April 1, 1990.

c. Carry out detailed pyrolysis/gc/ms studies on blocked CR-2898 - April 15, 1990.

d. Prepare sufficient blocked CR-2989 for run of machine-made cigarettes - May 1, 1990.

e. Contract out synthesis of large quantities of blocked CR-2898 if required.

IV. Project Tomorrow

A. Objective

To develop special cigarette papers which will control the burn rate of a cigarette.

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B. Introduction and Status

Work to date has shown that the burn rate of a cigarette can be retarded if some type of process is performed which results in bands of lower porosity on the cigarette paper. A paper of this type may have utility for Project Tomorrow. Two types of treatments are currently being investigated. The first involves treatment of normal cigarette paper with bands using either the gel phase of metal oxides or carbonates prepared by the sol-gel process or soluble phosphate burn retardants. Models made by hand-painting of sol-gel derived alumina gel gives a cigarette which burns more slowly in the treated area. A number of attempts have been made to coat paper with bands of two different sol-gels - the alumina sol-gel prepared at Lee Labs, and a magnesium hydroxide gel containing 3% alumina prepared at NY Poly. To date we have been unable to apply sufficient material using a rotogravure press to see any effect on mass burn rate. Similar problems have been encountered with both mono potassium and mono sodium phosphate. We are currently working to achieve an overall coating with the rotogravure press in order to compare mass burn rates of fully coated papers and banded papers at similar loading per unit area of paper. Problems have been encountered, however, in coating 25 g/m^2 basis weight papers caused by the low concentration of the solutions being used. It would appear at this time that the only viable material that can be used for this approach is mono sodium phosphate.

A second approach is to introduce bands of increased flax density where the additional flax contains no inorganic filler on the paper maker. Hand sheets have been made utilizing this approach, and results have been encouraging. However, at this time no method exists which would allow us to make paper with bands of this type commercially. A modified dandy roll has been designed which would allow the application of transverse bands of flax, or other fibers, on the Fourdrinier wire. Detailed drawings of parts is now in progress. When all necessary parts have been obtained, the apparatus will be installed on the pilot paper maker at the University of Maine.

The two strategies currently being pursued for Project Tomorrow are:

1. Prepare bobbins of paper for Project Tomorrow with transverse bands of mono sodium phosphate on the paper.

2. Develop potential methodology for applying dense flax bands to cigarette paper at the paper-making machine.

C. Tactics and Timetable

1. Prepare bobbins of paper for Project Tomorrow with transverse bands of mono sodium phosphate on the paper.

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a. Overall coat standard cigarette paper with a highly concentrated solution of mono sodium phosphate at two levels achieved by one and two passes on a rotogravure press - second quarter, 1990.

b. Apply transverse bands of mono sodium phosphate at the same levels as in (a) using a rotogravure press - second quarter, 1990.

c. Compare burn rate of cigarettes made from papers produced in (a) and (b) - second quarter, 1990.

2. Develop potential methodology for applying dense flax bands to cigarette paper at the paper-making machine.

a. Complete detailed drawings, and ordering and machining of parts for modified dandy roll - March 7, 1990.

b. Build modified dandy roll on to University of Maine pilot paper making machine - March 21, 1990.

c. Carry out trials at University of Maine for the production of bobbins of paper containing transverse flax bands - second quarter, 1990.

V. PM Web

A. Objective

To support the Filter Research and Development Program through the development of a CA web type material by the third quarter of 1990.

B. Introduction and Status

Paper filters have been shown to have a greater filter efficiency as compared to CA tow at equal filter RTDs. However, paper filters suffer from a subjective disadvantage compared to CA. Some time ago Celanese sampled us with a filter material they call CA web. This material is manufactured through a paper making process. A proprietary material Celanese calls fibrets enables a sheet to be made on a Fourdrinier wire. CA web is an extremely interesting material in that it appears to have the same filtration properties as paper, but the subjective response of CA. Unfortunately it appears that it will be at least two years, if not longer, before CA web can be commercialized. As a consequence the Paper Technology group has been asked to assist the Filter Research and Development group in the development of an alternative to CA web.

Three approaches are currently being investigated. The first involves the formation of PM web. This material is made from 75% cut (1/4") CA staple and 25% softwood fiber. The softwood fiber provides sufficient hydrogen bonding to allow a paper web to be formed on a Fourdrinier wire. Considerable work has been done in the hand sheet lab with this material, and several bobbins, varying only in the extent

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of softwood fiber refining, have recently been made at the University of Maine.

The second approach will investigate coating of paper filter web with both cellulose acetate and triacetin. Arrangements have been made at the James River Paper Company to coat the filter paper with acetone solutions of both materials. In order to move as rapidly as possible on this approach, we will use the most appropriate rotogravure cylinder James River has available which will provide only 80% coverage. If results are promising, we will have a ten inch cylinder made, and repeat the work on a larger scale.

The third approach is still in the research stage and would appear difficult to commercialize to date. This approach involves acetylation of the paper surface. Promising results have been obtained using acetic anhydride and potassium carbonate as the acetylation medium in the laboratory. However, the time required to achieve the desired degree of surface acetylation, two hours, is far too long to allow for a commercial process to be developed. An initial trial with a much more active catalyst, sulfoacetic acid, led to disintegration of the paper. Although work on this approach will continue for the present, it will be terminated if results from the coating trials are sufficiently encouraging.

As can be seen, the three strategies being employed to achieve the stated objective are:

1. Utilize paper making technology to form a filter material consisting of an appropriate mixture of CA and cellulose fiber.

2. Coat filter paper web with CA and/or triacetin to form a filter material with filtration properties similar to paper and subjective properties similar to CA.

3. Develop a technique for surface acetylation of filter paper web which can be commercialized.

C. **Tactics and Timetable**

1. Utilize paper making technology to form a filter material consisting of an appropriate mixture of CA and cellulose fiber.

a. Evaluate filters made from PM web at the University of Maine - second quarter, 1990.

b. Utilize information gained from (a) above to optimize PM web at the University of Maine - second quarter, 1990.

2. Coat filter paper web with CA and/or triacetin to form a filter material with filtration properties similar to paper and subjective properties similar to CA.

a. Coat filter paper web with acetone solutions of CA and triacetin at James River - February 19, 1990.

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b. Evaluate filters made from coated papers - second quarter, 1990.

c. If results from (b) above are promising, fabricate ten inch rotogravure cylinder and coat papers with a range of concentrations of CA and/or triacetin - second quarter, 1990.

3. Develop a technique for surface acetylation of filter paper web which can be commercialized.

a. Continue experiments with sulfoacetic acid - second quarter, 1990.

b. Investigate other catalysts and solvents for acetylation reaction - second quarter, 1990.

c. Contact recommended paper manufacturers to discuss potential commercialization of such a process - second quarter, 1990.

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Appendix A

It is anticipated at this time that the majority of the effort for the Paper Technology Program after 1990 will be in the area of reduced sidestream and Project Tomorrow. However, it is also anticipated that much of the effort devoted to the reduced sidestream program will shift to the second objective; namely, the development of papers which can reduce sidestream odor and irritation. During the next six months a plan will be developed to address this issue. This plan will involve the following strategies:

1. Identify chemical classes of compounds which are responsible for sidestream odor and irritation.

2. Investigate the effect of known catalysts incorporated into the wrapper on sidestream odor and irritation.

3. Investigate the effect of substances which are known to react with aldehydes, amines, and sulfur compounds on sidestream odor and irritation when incorporated into the wrapper.

4. Establish an objective method for determining sidestream irritation.

5. Rank blend components using single component cigarettes with regard to sidestream odor and irritation.

6. Collaborate closely with personnel in Project Ambrosia regarding the effects of specific flavorants on sidestream odor.

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. Cathy Ellis **Date:** October 1, 1990

From: R. W. Dwyer

Subject: Abstract of the Project Tomorrow presentation at the September Planning Conference

On August 10, 1990 The Fire Safe Cigarette Act of 1990 was signed into law. This law empowers the Consumer Product Safety Commision to direct the National Institute of Standards and Technology's Center for Fire Research to complete research on cigarette fire safety. Specifically, it calls for CFR to develop a standard method to determine cigarette ignition propensity; compile performance data for cigarettes using this standard method; and, to conduct laboratory studies on and computer modeling of ignition physics.

The goal of Project Tomorrow is to evaluate the feasibility of our developing a cigarette ignition-propensity test and to evaluate the technical and commercial feasibility of producing cigarettes with reduced ignition propensities with respect to such a test.

This goal is being pursued through four main strategies:

1. ignition test development and relating cigarette design parameters to such tests
2. developing computer models of smouldering cigarettes on substrates
3. evaluating the technical and commercial feasibility of producing cigarettes at a mass burn rate of 40 mg/min
4. exploring wrapper and filler technologies for increasing cigarette fire safety

cc: Central Files

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. Cliff Lilly Date: February 15,-1990

From: R. W. Dwyer and D. J. Newman

Subject: Operational Plan for Project Tomorrow

GOAL: Re-design all of our cigarette brands to achieve mass-burn-rate targets while maintaining their current delivery and subjective properties.

STRATEGY A: Develop filler and wrapper modifications to achieve mass-burn-rate targets.

BENCHMARKS AND TARGET DATES:

1) Evaluate the effects of filler additives DAP and $MgSO_4$ on the burn rates and subjectives of cigarettes (D. Newman).....1Q90
2) Modify cigarette design computer program to account for the effects of these filler additives (J. Kao).....1Q90
3) Evaluate the effects of burn-control zones on cigarette performance and subjectives (B. Dwyer , L. Goodwin, & S. Baldwin).....2Q90
4) Develop means of applying bands of burn-control agents to cigarette wrappers (B. Geiszler & B. Rogers).....2Q90
5) Develop means of incorporating burn-control zones into the paper during the paper-making process (B. Geiszler & B. Rogers).....2Q90
6) Develop leaf blends which provide lowered MBR's (C. Moogalian).2Q90
7) Evaluate the effects of wood-pulp wrappers on MBR's (D. Newman & L. Goodwin).....1Q90

STRATEGY B: Design and evaluate low MBR versions of selected models.

BENCHMARKS AND TARGET DATES:

1) Select brands for examination which include representatives of major blends and delivery levels (D. Newman).....1Q90
2) Design, fabricate, and test versions which have acceptable delivery properties at MBR's ranging from 35 to 60 mg/m (B. Dwyer & D. Newman).....on-going
3) Subjectively evaluate above cigarettes, and reformulate blends and flavors to provide optimum products (C. Moogalian & G. Yatrakis) .....on-going
4) Select a model which will have its MBR lowered in stages over time, for consumer testing (D. Newman & B. Dwyer).....2Q90
5) Perform factory trials of 20 CPI (D. Newman).....2Q90
6) Explore the possibility of developing blends for lowered rod densities (C. Moogalian).....2Q90

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7) Examine alternative processes for producing lower-density rods including tobacco conveyance and low-temperature expansion (**E. Craze**).....4Q90
8) Design, fabricate, and test cigarettes with burn-control agents banded on wrapper (**S. Baldwin, B. Geiszler, & D. Newman**).....3Q90
9) Explore the use of embossed wrappers for tobacco weight reductions (**D. Newman**).....2Q90
10) Design, construct, and test low-MBR versions with extinguishment bands located near the tipping paper (**D. Newman & L. Goodwin**)..2Q90
11) Review all results and find designs for selected models which involve the least modifications to achieve MBR and subjective targets (**B. Dwyer & D. Newman**).....4Q90

STRATEGY C: Design, implement, and apply an ignition-propensity test.

1) Select base fabric, foam, and geometry for test; develop an ignition endpoint and protocol; determine the number of samples required for sound statistics (**L. Goodwin, A. Kassman, & B. Dwyer**).....2Q90
2) Have fabrics washed and treated with potassium acetate at varying levels; determine salt loadings which distinguish between: 40 & 50 mg/m; 50 & 60 mg/m; 60 & 70 mg/m (**B. Dwyer & L. Goodwin**).....2Q90
3) Determine the effects of cigarette circumference on our ignition propensity test (**B. Dwyer & L. Goodwin**).....3Q90
4) Evaluate the effects of embossed wrappers on ignition propensity (**A. Kassman, D. Newman, L. Goodwin**).....2Q90
5) Validate protocol and materials with repeated testing over time (**B. Dwyer, A. Kassman, & L. Goodwin**).....4Q90
6) Design second-generation ignition-propensity test based on results from 1-5 (**A. Kassman, J. Whidby, & B. Dwyer**).....1Q91

RESOURCE ALLOCATIONS

2.0	PHYSICAL RESEARCH
0.5	PRODUCT DEVELOPMENT
0.5	CHEMICAL RESEARCH
3.0	TOBACCO FUNDAMENTALS
0.25	ANALYTICAL RESEARCH
1.0	CIGARETTE TESTING
1.0	TOBACCO PROCESSING & FABRICATION
0.5	PRODUCT EVALUATION
0.5	FLAVOR DEVELOPMENT
0.25	CIGARETTE TECHNOLOGY
0.25	COMPUTER APPLICATIONS
0.25	LEAF
1.0	UNIVERSITY OF MAINE
1.0	NEW YORK POLYTECHNIC UNIVERSITY
1.0	VIRGINIA POLYTECHNIC INSTITUTE & STATE UNIVERSITY
13.0	TOTAL

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RWDwyer
D J Newman/RWD

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: C. Ellis **Date:** October 1, 1990

From: K. A. Cox

Subject: Abstract of the Optical Processing Program Presentation Given at the September R&D Planning Meeting

The current focus of the optical processing program is on the development of three types of inspection systems. These systems are being developed for the on-line inspection of cigarette packs, the on-line inspection of print web at the printer and the off-line inspection of printed materials at the printer and within the QA Department. The status and plans for these development efforts were reviewed.

Pack Inspection

The pack inspection system under development (OSIRIS) is based on proprietary inspection algorithms developed as part of the program. The U.S. Patent Office has issued a Notice of Allowance on the first patent application protecting these algorithms. A patent will issue in 3-5 months. Further protection of these algorithms and the unique inspection procedure is being pursued through the filing of three additional patent applications. The development of the factory prototype pack inspection system is now well underway. The detailed system specifications have been developed, the hardware has been received and integrated and 30% of the coding completed. Several display screens were shown to illustrate a number of the system features and its ease of use. The software development is scheduled for completion on November 30, 1990. Laboratory evaluation and debugging will take place in December and a factory trial at Stockton Street will immediately follow.

On-line Web Inspection

The development of an on-line print web inspection system was initiated in the second quarter of this year. The system will initially be installed at Colonial Heights Packaging (CHP). The performance specifications for the system have been developed with the assistance of CHP personnel. An image acquisition rate 40 times greater than that of the pack inspection system is required to satisfy the performance specifications. A review of available technology relevant to this application has been completed. No commercial solutions were found. The most promising technology identified is under development by Electronic Technology in Imaging (ETI) in conjunction with Dupont. A single camera laboratory web inspection system based on ETI hardware will be developed in Q4 '90. This system will be used to evaluate cameras, lighting systems and proposed inspection algorithms. The information provided by this system will be used to design a factory prototype web inspection system. The design will be initiated by the end of Q4 '90.

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Resources

The resource projections for the upcoming quarter show increased support from both the IS and Engineering Departments (1 and .5, respectively). Within R&D, the program is supported by the Vision Inspection Technologies project in the Physical Research Division (6), the Computer Applications Division (1) and Development Engineering (.5).

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Updated

Operational Plan for the Optical Processing Program

K. A. Cox
March, 1990

Ken Cox

A. Objective

In collaboration with Engineering and IS, apply both optical and digital processing techniques to the development and implementation of high speed product inspection systems.

B. Background

In July of 1987, an optics laboratory staffed by an associate senior scientist was established within the Physical Research Division. A research scientist was added to the effort in October, a senior scientist in January of 1988, a technician in June, and a research electrical engineer added in December.

In November of 1988, a unique digital inspection system, developed within the optical processing program, was demonstrated to R & D management from several of the Philip Morris operating companies. The system had an automatic training feature and the capability for high resolution inspection at the rate of 10 objects per second.

In the summer of 1989, a prototype off-line closure stamp inspection system developed within the program was transferred to QA for evaluation.

In December of 1989, the laboratory prototype of the pack inspection system was evaluated at Stockton Street. The system performed well. The development of a factory prototype is now underway.

C. Status

The effort of the optical processing program is currently directed toward the solution of four different inspection problems. These include the off-line inspection of package blanks and cut closure stamps, the on-line inspection of cigarette packs and the inspection of print web at the printer.

1. Cut Closure Stamp Inspection

An off-line cut closure stamp inspection system is being developed at the request of the Quality Assurance Department. The initial objective is to provide an automated system capable of detecting the presence of a blank closure within a stack of closures. An inspection system meeting the first objective has been developed and is currently undergoing evaluation in the QA department.

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2. Package Blank Inspection System

An off-line inspection system is being developed for the computer-aided inspection of package blanks. This project is also being undertaken at the request of QA. The system will be used to assist in the detection of small differences between a package blank and the corresponding master artwork used to engrave the printing cylinder. An inspection method has been devised and an inspection station designed and assembled. The station includes an imaging system along with a computer controlled translating table and filter wheel. Software development is in progress and the system nearing completion.

3. Cigarette Pack Inspection System

Much of the effort of the optical processing program to date has been directed toward the development of an on-line cigarette pack inspection system. The objective is to develop a system which can be simply set up for a new inspection problem, provides total image inspection (global) and yields informative feedback to enable optimization of packer performance. The target inspection rate is three views per unit at 15 units per second with a false rejection limit of .1%.

The initial effort was directed toward the development of an inspection algorithm which could be implemented optically. It was found, however, that the algorithm developed, after slight modification, could be implemented digitally with commercially available hardware to achieve the inspection objective. The result is a digital processor based inspection system with many of the characteristics of an optical processor based system. In particular, the system has the capability for total image inspection and is trained simply by presenting the system with examples of good images.

During the first half of 1989, a number of improvements were made to the inspection algorithm, and an evaluation of the method was carried out in a simulated manufacturing environment. The evaluation was carried out by inspecting Lark pack images obtained while the packs were being conveyed by Engineering's prototype vacuum conveyor. The results were excellent.

The major achievement of the second half of 1989 was the successful completion of a factory trial of the laboratory inspection system. The laboratory inspection system consisted of a Sun 4 workstation with an Androx image processing board. The trial was carried out at Stockton Street during a three week period in December. The system performed well and the trial provided essential information for the development of the factory prototype inspection system. The factory prototype will be suitable for long term factory installation. It will be constructed from commercially available hardware, have greater inspection capability and a software user interface designed to minimize the skill required to operate the system. The development of the factory prototype is currently underway and will be the major activity of the optical processing program during 1990.

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4. High Speed Print Inspection

The Quality Assurance Department has expressed a strong interest in the implementation of print quality inspection at the printer. This additional inspection step would reduce the number of defects encountered at the packer and generally increase the quality of the print. The algorithm that has been developed for the inspection of cigarette packs is also well suited for this problem. However, the inspection speed requirements at the printer are 5 times greater than for the pack inspection problem. It is believed that the hardware needed is now commercially available.

D. Strategies

1. Design and construct a factory prototype of the PM pack inspection system.

2. Provide temporary support for the closure stamp inspection system previously installed in the QA Department.

3. Develop, install (in QA), and provide temporary support for the off-line, package blank inspection system.

4. Develop a system for the global inspection of print web on the printing press.

5. Continue the collaborative relationship with CMU.

E. Tactics

1. Strategy 1

a. Complete the detailed software specifications for the factory prototype. (Q2)

b. Complete the software development and laboratory testing and initiate a factory trial (beta testing). (Q4)

2. Strategy 2

b. Continue to support and evaluate the closure stamp inspection system previously installed in the QA department.

c. Identify alternate computer hardware suitable for long term installation. (Q3)

d. Install a permanent inspection system and transfer support responsibility to a 3rd party. (Q4)

3. Strategy 3

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a. Complete laboratory testing of the package blank inspection system.

b. Transfer the system to QA for evaluation. (Q1)

c. Identify alternate computer hardware suitable for long term installation. (Q3)

d. Facilitate the establishment of a mechanism for transferring digital representations of blank masters among Purchasing, the printer and QA. (Q4)

4. Strategy 4

a. Complete a review of current technology applicable to the inspection of print web. (Q2)

b. Collaborate with Colonial Heights Packaging in specifying the system capabilities needed. (Q2)

c. Create a development plan for the inspection system. (Q2)

5. Strategy 5

a. Continue reviewing the CMU program on a quarterly basis.

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RESOURCE ALLOCATIONS

R & D

1. Ken Cox, Associate Senior Scientist (1/2 time)
2. Henry Dante, Research Scientist
3. Charles Harward, Associate Senior Scientist
4. Dave Lowitz, Senior Scientist
5. Bob Maher, Research Scientist
6. Michael Mullins, Technician (T4)
7. Miles Waugh, Associate Principal Scientist

Total R & D resource allocation = 6.5

Engineering

Total Engineering resource allocation = .25

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Operational Plan for the Optical Processing Program

K. A. Cox
February, 1990

A. Objective

In collaboration with Engineering and IS, apply both optical and digital processing techniques to the development and implementation of high speed product inspection systems.

B. Background

In December, 1986, an in-house optical processing course was presented by Dr. David Casasent, a professor at Carnegie Mellon University and a widely recognized leader in the field. The course and a subsequent trip to Dr. Casasent's laboratory convinced a number of people in R & D and Engineering that optical processing techniques could be powerful tools for the inspection of PM products. In February of 1987, B. C. LaRoy of R & D and E. E. Richardson of Engineering proposed plans for a joint R & D/Engineering program.

In July of 1987, an optics laboratory staffed by an associate senior scientist was established within the Physical Research Division. A research scientist was added to the effort in October, a senior scientist in January of 1988, a technician in June, and a research electrical engineer added in December.

In November of 1988, a unique digital inspection system, developed within the optical processing program, was demonstrated to R & D management from several of the Philip Morris operating companies. The system had an automatic training feature and the capability for high resolution inspection at the rate of 10 objects per second.

In the summer of 1989, a prototype off-line closure stamp inspection system developed within the program was transferred to QA for evaluation.

In December of 1989, the laboratory prototype of the pack inspection system was evaluated at Stockton Street. The system performed well. The development of a factory prototype is now underway.

C. Status

The effort of the optical processing program is currently directed toward the solution of five different inspection problems. These include the off-line inspection of package blanks and cut closure stamps, the on-line inspection of cigarette packs and individual cigarettes, and the inspection of print web at the printer.

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1. Cut Closure Stamp Inspection

An off-line cut closure stamp inspection system is being developed at the request of the Quality Assurance Department. The initial objective is to provide an automated system capable of detecting the presence of a blank closure within a stack of closures. The capabilities of the system will subsequently be enhanced to allow it to also reject stamps with unsatisfactory print-to-cut registration. An inspection system meeting the first objective has been developed and is currently undergoing evaluation in the QA department.

2. Package Blank Inspection System

An off-line inspection system is being developed for the computer-aided inspection of package blanks. This project is also being undertaken at the request of QA. The system will be used to assist in the detection of small differences between a package blank and the corresponding master artwork used to engrave the printing cylinder. An inspection method has been devised and an inspection station designed and assembled. The station includes an imaging system along with a computer controlled translating table and filter wheel. Software development is in progress and the system nearing completion.

3. Cigarette Pack Inspection System

Much of the effort of the optical processing program to date has been directed toward the development of an on-line cigarette pack inspection system. The objective is to develop a system which can be simply set up for a new inspection problem, provides total image inspection (global) and yields informative feedback to enable optimization of packer performance. The target inspection rate is three views per unit at 15 units per second with a false rejection limit of .1%.

The initial effort was directed toward the development of an inspection algorithm which could be implemented optically. It was found, however, that the algorithm developed, after slight modification, could be implemented digitally with commercially available hardware to achieve the inspection objective. The result is a digital processor based inspection system with many of the characteristics of an optical processor based system. In particular, the system has the capability for total image inspection and is trained simply by presenting the system with examples of good images.

During the first half of 1989, a number of improvements were made to the inspection algorithm, and an evaluation of the method was carried out in a simulated manufacturing environment. The evaluation was carried out by inspecting Lark pack images obtained while the packs were being conveyed by Engineering's prototype vacuum conveyor. The results were excellent.

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The major achievement of the second half of 1989 was the successful completion of a factory trial of the laboratory inspection system. The laboratory inspection system consisted of a Sun 4 workstation with an Androx image processing board. The trial was carried out at Stockton Street during a three week period in December. The system performed well and the trial provided essential information for the development of the factory prototype inspection system. The factory prototype will be suitable for long term factory installation. It will be constructed from commercially available hardware, have greater inspection capability and a software user interface designed to minimize the skill required to operate the system. The development of the factory prototype is currently underway and will be the major activity of the optical processing program during 1990.

4. **Individual Cigarette Inspection**

The inspection of individual cigarettes presents new problems not encountered in the pack inspection problem. Of these, the two most challenging are the increased speed requirements (a factor of 17 for .1 mm resolution images) and the difficulty of acquiring a complete view of the cigarette during the making process.

The effort to date has concentrated on image acquisition with the expectation that the high speed processor needed will be available commercially. Both diode array and acoustooptic (AO) laser scanning systems are under consideration for image acquisition.

5. **High Speed Print Inspection**

The Quality Assurance Department has expressed a strong interest in the implementation of print quality inspection at the printer. This additional inspection step would reduce the number of defects encountered at the packer and generally increase the quality of the print. The algorithm that has been developed for the inspection of cigarette packs is also well suited for this problem. However, the inspection speed requirements at the printer are 5 times greater than for the pack inspection problem. It is believed that the hardware needed is now commercially available. Many of the obstacles that need to be overcome for the development of a print inspection system are common to both print inspection and to the inspection of individual cigarettes. During 1990, a higher priority will be placed on the cigarette inspection system. The progress expected in the development of a print inspection system will be almost entirely derived from its similarity to the former.

D. Strategies

1. Design and construct a factory prototype of the PM pack inspection system.

2. Provide temporary support for the closure stamp inspection system previously installed in the QA Department.

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3. Develop, install (in QA), and provide temporary support for the off-line, package blank inspection system.

4. Implement an individual cigarette inspection system in the laboratory.

5. Continue the collaborative relationship with CMU.

E. Tactics

1. Strategy 1

a. Acquire the cameras, computer and image analysis hardware previously specified for the factory prototype of the pack inspection system. (Q1, 1990)

b. Install a vacuum conveyor and merry-go-round in the laboratory for testing of the inspection system in a simulated manufacturing environment. (Q1)

c. Complete the detailed software specifications for the factory prototype. (Q2)

d. Complete the software development and laboratory testing and initiate a factory trial (beta testing). (Jan. 1, 1991)

e. Complete the system documentation in preparation for a permanent factory installation. (Q1, 1991)

2. Strategy 2

b. Continue to support and evaluate the closure stamp inspection system previously installed in the QA department.

c. Identify alternate computer hardware suitable for long term installation. (Q2, 1990)

d. Install a permanent inspection system and transfer support responsibility to a 3rd party. (Q4, 1990)

3. Strategy 3

a. Complete laboratory testing of the package blank inspection system.

b. Transfer the system to QA for evaluation. (Q1, 1990)

c. Identify alternate computer hardware suitable for long term installation. (Q2, 1990)

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d. Facilitate the establishment of a mechanism for transferring digital representations of blank masters among purchasing, the printer and QA. (Q4, 1990)

4. Strategy 4

a. Develop a line scan image acquisition system capable of capturing surface images of cigarettes turned on a roll drum. Test the system in the laboratory using a rotating drum with printed material attached to the surface. (Q2, 1990)

b. Carry out a preliminary evaluation of the suitability of the roll drum at the training center. (Of particular concern is the clarity of the image.) (Q2, 1990)

c. If sufficient promise is shown in the preliminary evaluation, develop a laboratory cigarettte inspection system using the roll drum concept. (Q1, 1991)

5. Strategy 5

a. Continue reviewing the CMU program on a quarterly basis.

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RESOURCE ALLOCATIONS

R & D

1. Ken Cox, Associate Senior Scientist (1/2 time)
2. Henry Dante, Research Scientist
3. Charles Harward, Associate Senior Scientist
4. Dave Lowitz, Senior Scientist
5. Bob Maher, Research Scientist
6. Michael Mullins, Technician (T4)
7. Miles Waugh, Associate Principal Scientist

Total R & D resource allocation = 6.5

Engineering

Total Engineering resource allocation = .25

K.A.C.

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Abstract

Low Tar High Flavor

One program was discussed: Project Bold. This program encompasses the development of an 85mm 1mg and 100mm 2mg product using blend, flavor and filter systems designed to be subjectively superior when tested versus Carlton and Now. The blend, flavor and filter systems were outlined as well as current consumer research.

Plans included additional monadic POL testing of current products, additional primary and make/pack trials (menthol products also) and scheduling of a factory trial. Test market of an 85/100mm product is tentatively scheduled for first quarter, 1991.

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. C. L. Ellis **Date:** March 29. 1990

From: W. R. Raymond

Subject: **Low Tar/High Flavor Program**

There are no changes to the 1990 LTHF Program Operational Plan, as submitted to you on February 15, 1990.

W. R. Raymond

cc: R. Heretick
C. Lilly
J. Myracle
H. Spielberg
J. Spruill
G. Yatrakis

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. C. L. Ellis

Date: February 15, 1990

From: H. L. Spielberg

Subject: 1990 Operational Plans -- Low Tar/High Flavor Program

Attached is a copy of the 1990 Operational Plans for the Low Tar/High Flavor Program.

If you have questions, please call me.

H. L. Spielberg

Attachment

cc: R. Heretick
C. Lilly
J. Myracle
W. Raymond

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LOW TAR/HIGH FLAVOR PROGRAM

1990 Operational Plans

February 13, 1990

I. **Objective**: To develop ultra-low tar and/or reduced nicotine cigarettes equal subjectively to cigarettes with at least twice the tar and/or nicotine utilizing conventional technology and, as appropriate, technological advances from other programs, particularly those proprietary PM technologies such as ART which may provide a competitive marketing edge for the Company.

II. **Strategies/Timetables**:

A. STRATEGY I -- DEVELOP 2 AND 6 MG CIGARETTES WITH ENHANCED TOTAL SUBJECTIVE CHARACTER.

1. Project 202/235 - Initial emphasis will be toward completion of baseline prototypes, using Blend 218 and paper/CA filters (66% ventilation), with white and cork-on-white tipping, through monadic POL testing. These prototypes will serve as benchmarks for further development of 2mg tar regular and reduced-nicotine cigarettes. Additional filter options are being considered including longer filters and all-paper filters. Additional monadic POL testing of improved 2mg prototypes and appropriate competitive brands will be conducted.

POL 0246	1st Qtr., 1990
Additional monadic POL testing	2nd Qtr., 1990

2. Project 605 - A monadic POL is planned for a Blend A model using a 2.6 dpf/42000 denier filter and a Winston-type aftercut. In addition to evaluation of several aftercut flavor directions with Blend A, parallel evaluations will be conducted with Blend 218 (Project 202). Additional filter options will continue to be be explored. The best overall prototype will be tested monadically with Marlboro Lights and appropriate competitive brands.

POL 0245	February, 1990
Additional monadic POL testing	2nd Qtr., 1990

3. Project NOVENT - Evaluation of ESP papers will continue, along with various filter options, using Blend A.

Final optimized prototype	2nd Qtr., 1990
External testing	2nd Qtr., 1990

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B. STRATEGY II -- "ULTIMA" -- DEVELOP ULTRALOW TAR (1-3MG) PRODUCTS WHICH WILL PROVIDE A COMPETITIVE EDGE IN THE EXISTING U.L. MARKET SEGMENT.

1. U.L. Segment Assessment - Target brands will be Carlton, Now and Kent III families as well as European brands delivering ≤2mg tar. Complete analytical characterization will be done for all brands including C.I., blend composition, flavor composition, and nontobacco materials. Internal subjective profiling and monadic POL testing of target brand families also will be performed. Data from these studies, together with brand histories, demographics and switching research data, will be used to formulate definitive development tactics.

Target brand subjective profiles	February, 1990
Complete target brand data	1st Qtr., 1990
Complete target brand POL testing	2nd Qtr., 1990

2. Initial Prototype Directions - Exploratory prototypes, encompassing several potential unique marketing concepts, are in progress and will be monadically POL tested against the target brands. These prototypes potentially may include: (a) 1, 2, and 3mg MFUL and MUL system-based models with CA filters; (b) a 2mg ART model; (c) a 2mg "no additive" model (water only) and (d) the best current Project 202 prototype. Based on complete target brand data and prototype subjective performance, one or more of these prototypes and/or additional prototypes will be refined for further monadic POL testing. POL results will be used to guide subsequent product direction(s) and development activities for regular and menthol systems.

Exploratory prototype development	February, 1990
Begin prototype monadic POL testing	2nd Qtr., 1990

C. STRATEGY III -- "BEST OF THE LOWEST" -- DEVELOP PRODUCTS WHICH UTILIZE PROPRIETARY PM TECHNOLOGIES, VIZ., TAR REDUCTION, NICOTINE CONTROL, FLAVOR DELIVERY, ETC., WHICH WILL DEMONSTRATE CONSUMER ADVANTAGES VIA R.G.A. TESTING.

1. Ultra-low Tar Product Development - Baseline prototype development will begin with conventional low tar blends (Blend 218, and MUL Blend) incorporating 10% ART ET. Several generations of prototypes (1mg 85mm, 2-2.5mg 100mm) are planned, beginning with more conventional materials and construction and then gradually incorporating new filter, paper, blend, processing, construction and flavor technologies as available through short- and long-term R&D programs. Initial focus will be on processing and ART-inclusion blend development, addressing issues such as blend component extraction, total blend expansion, degree of nicotine extraction and cut filler blending. Target brands will be the

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

same as for "Ultima", using target brand analytical and historical data from that program for additional direction. Acceptable proprietary technology prototypes, both regular and menthol, will undergo R.G.A. testing.

Baseline prototypes	February, 1990
Proprietary process prototypes	1st Qtr., 1990
ART-inclusion blends/process studies	2nd Qtr., 1990
Blend, filter, flavor development	2nd Qtr., 1990
Optimized prototypes	3rd Qtr., 1990
R.G.A. testing	3rd Qtr., 1990

2. PM Family Nicotine Segmented Line Extension - The objective will be to develop line extensions for existing PM brand families which deliver half the current smoke nicotine in each tar segment. Development will commence with the B&H family, initially incorporating full extraction ART filler into the B&H blend to achieve 50% nicotine reduction in a full flavor baseline prototype. Process and blend development work will proceed according to the ultralow product timetable above. Controlled nicotine extraction and expansion of the total B&H blend also will be evaluated. Conventional B&H construction will be used with adjustments as necessary. Monadic POL tests of B&H 100s and Lights 100s will be conducted to obtain current brand baseline information. Flavor development activities will be directed toward maintaining the B&H signature in 50% nicotine-reduced prototypes, for both regular and menthol systems.

Baseline full flavor prototype (55% ART/45% B&H blend)	February, 1990
Complete blend/process development	2nd Qtr., 1990
Complete monadic POL testing	2nd Qtr., 1990
Initial prototype testing	2nd Qtr., 1990

D. STRATEGY IV -- FILTER RESEARCH & DEVELOPMENT:

1. Filter Design & Materials - Continued emphasis is expected on development of new filter components and designs for increased efficiency at constant RTD, selective filtration and gas phase control at reduced ventilation. Among new high efficiency materials which will continue in development and testing are PM web, acetylated paper and CA-coated paper, with the following objectives: (1) subjective improvement over paper/CA filters, (2) increased filtration efficiency, (3) acceptable rod physical properties and (4) production feasability. Work also will continue on concentric filters to optimize physical and subjective performance. Carbon studies will continue to: (1) identify acceptable substitutes for current materials, (2) assess additive and filter loading effects on smoke subjective quality and (3) develop new gas phase analytical criteria and attempt to establish relationships between gas phase composition and cigarette subjective quality.

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2. Filter Additives - Further work is planned to assess potential filter additives for masking/reduction of paper filter off taste. Additive work may continue to reduce nicotine delivery.

E. STRATEGY V -- PAPER TECHNOLOGY:

Support from the paper technology program is expected to continue in two key areas: (1) development of acceptable, high-efficiency filter materials (see D-2) and development of new cigarette papers for burn rate and puff count control. Extensive work is expected on sol-gel technology during 1990.

F. STRATEGY VI -- FLAVOR RESEARCH & DEVELOPMENT:

1. Release Compound Research - Work will continue on development and application of CR and vendor release compound technology for flavor delivery in mainstream smoke. A possible application of this technology, which will be explored, is to increase perceived impact and response in low tar products via specific release compounds applied to paper. Process work with GMC will continue for direct application to filler for charcoal-filtered products.

2. New Flavor Screening - Screening will continue on new vendor flavor submissions as received, seeking flavors which may enhance specific or general subjective smoke characteristics in low tar products.

3. Tobacco Extract Fractionation - Process and application testing in progress will continue to demonstrate subjective utility of Flue-cured and Burley fractions through POL tests on low tar regular and ART-based prototypes. Based on subjective results, a decision will be made regarding pilot or commercial scale-up of the process. Analytical characterization of fractions will continue.

POL testing on low tar regular and ART prototypes	3rd Qtr., 1990

4. Flavor Encapsulation -- Work on microencapsulation technology development for menthol will continue both inhouse and externally. Currently, plans are in progress for a visit to Southwest Research Institute to discuss technology development and pilot-scale capsule production. Extensive work is planned: (a) to reduce capsule size for direct application to tobacco and (b) to optimize menthol storage retention and delivery. Based on success of menthol work, further flavor applications of alginate-based microencapsulation technology may be evaluated.

Initial SWRI contact	February, 1990
Prototype SWRI menthol capsules	2nd Qtr., 1990

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

III. **Resource Allocations**:

PROJECT GROUP	MAN-YEARS
Domestic Flavor Development (2304)	1.9
Applied Flavor Investigation (2305)	0.5
Basic Flavor Investigation (2307)	1.5
Other	0.3
TOTAL FLAVOR DEVELOPMENT PROJECTED, 1990	4.2
CURRENT, 1990	2.0
DIFFERENCE, PROJECTED VS CURRENT	2.2

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

LOW TAR/HIGH FLAVOR PROGRAM

1990 Operational Plans

February 13, 1990

I. **Objective**: To develop ultra-low tar and/or reduced nicotine cigarettes equal subjectively to cigarettes with at least twice the tar and/or nicotine utilizing conventional technology and, as appropriate, technological advances from other programs, particularly those proprietary PM technologies such as ART which may provide a competitive marketing edge for the Company.

II. **Strategies**:

A. STRATEGY I -- DEVELOP 2 AND 6 MG CIGARETTES WITH ENHANCED TOTAL SUBJECTIVE CHARACTER.

1. Project 202/235 - Initial emphasis will be toward completion of baseline prototypes, using Blend 218 and paper/CA filters (66% ventilation), with white and cork-on-white tipping, through monadic POL testing. These prototypes will serve as benchmarks for further development of 2mg tar regular and reduced-nicotine cigarettes. Additional filter options are being considered including longer filters and all-paper filters. Additional monadic POL testing of improved 2mg prototypes and appropriate competitive brands will be conducted.

POL 0246	1st Qtr., 1990
Additional monadic POL testing	2nd Qtr., 1990

2. Project 605 - A monadic POL is planned for a Blend A model using a 2.6 dpf/42000 denier filter and a Winston-type aftercut. In addition to evaluation of several aftercut flavor directions with Blend A, parallel evaluations will be conducted with Blend 218 (Project 202). Additional filter options will continue to be be explored. The best overall prototype will be tested monadically with Marlboro Lights and appropriate competitive brands.

POL 0245	February, 1990
Additional monadic POL testing	2nd Qtr., 1990

3. Project NOVENT - Evaluation of ESP papers will continue, along with various filter options, using Blend A.

Final optimized prototype	2nd Qtr., 1990
External testing	2nd Qtr., 1990

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B. STRATEGY II -- "ULTIMA" -- DEVELOP ULTRALOW TAR (1-3MG) PRODUCTS WHICH WILL PROVIDE A COMPETITIVE EDGE IN THE EXISTING U.L. MARKET SEGMENT.

1. U.L. Segment Assessment - Target brands will be Carlton, Now and Kent III families as well as European brands delivering ≤2mg tar. Complete analytical characterization will be done for all brands including C.I., blend composition, flavor composition, and nontobacco materials. Internal subjective profiling and monadic POL testing of target brand families also will be performed. Data from these studies, together with brand histories, demographics and switching research data, will be used to formulate definitive development tactics.

Target brand subjective profiles	February, 1990
Complete target brand data	1st Qtr., 1990
Complete target brand POL testing	2nd Qtr., 1990

2. Initial Prototype Directions - Exploratory prototypes, encompassing several potential unique marketing concepts, are in progress and will be monadically POL tested against the target brands. These prototypes potentially may include: (a) 1, 2, and 3mg MFUL and MUL system-based models with CA filters; (b) a 2mg ART model; (c) a 2mg "no additive" model (water only) and (d) the best current Project 202 prototype. Based on complete target brand data and prototype subjective performance, one or more of these prototypes and/or additional prototypes will be refined for further monadic POL testing. POL results will be used to guide subsequent product direction(s) and development activities for regular and menthol systems.

Exploratory prototype development	February, 1990
Begin prototype monadic POL testing	2nd Qtr., 1990

C. STRATEGY III -- "BEST OF THE LOWEST" -- DEVELOP PRODUCTS WHICH UTILIZE PROPRIETARY PM TECHNOLOGIES, VIZ., TAR REDUCTION, NICOTINE CONTROL, FLAVOR DELIVERY, ETC., WHICH WILL DEMONSTRATE CONSUMER ADVANTAGES VIA R.G.A. TESTING.

1. Ultra-low Tar Product Development - Baseline prototype development will begin with conventional low tar blends (Blend 218, and MUL Blend) incorporating 10% ART ET. Several generations of prototypes (1mg 85mm, 2-2.5mg 100mm) are planned, beginning with more conventional materials and construction and then gradually incorporating new filter, paper, blend, processing, construction and flavor technologies as available through short- and long-term R&D programs. Initial focus will be on processing and ART-inclusion blend development, addressing issues such as blend component extraction, total blend expansion, degree of nicotine extraction and cut filler blending. Target brands will be the

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same as for "Ultima", using target brand analytical and historical data from that program for additional direction. Acceptable proprietary technology prototypes, both regular and menthol, will undergo R.G.A. testing.

Baseline prototypes	February, 1990
Proprietary process prototypes	1st Qtr., 1990
ART-inclusion blends/process studies	2nd Qtr., 1990
Blend, filter, flavor development	2nd Qtr., 1990
Optimized prototypes	3rd Qtr., 1990
R.G.A. testing	3rd Qtr., 1990

2. PM Family Nicotine Segmented Line Extension - The objective will be to develop line extensions for existing PM brand families which deliver half the current smoke nicotine in each tar segment. Development will commence with the B&H family, initially incorporating full extraction ART filler into the B&H blend to achieve 50% nicotine reduction in a full flavor baseline prototype. Process and blend development work will proceed according to the ultralow product timetable above. Controlled nicotine extraction and expansion of the total B&H blend also will be evaluated. Conventional B&H construction will be used with adjustments as necessary. Monadic POL tests of B&H 100s and Lights 100s will be conducted to obtain current brand baseline information. Flavor development activities will be directed toward maintaining the B&H signature in 50% nicotine-reduced prototypes, for both regular and menthol systems.

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

2. Filter Additives - Further work is planned to assess potential filter additives for masking/reduction of paper filter off taste. Additive work may continue to reduce nicotine delivery.

E. STRATEGY V -- PAPER TECHNOLOGY:

Support from the paper technology program is expected to continue in two key areas: (1) development of acceptable, high-efficiency filter materials (see D-2) and development of new cigarette papers for burn rate and puff count control. Extensive work is expected on sol-gel technology during 1990.

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2. New Flavor Screening - Screening will continue on new vendor flavor submissions as received, seeking flavors which may enhance specific or general subjective smoke characteristics in low tar products.

3. Tobacco Extract Fractionation - Process and application testing in progress will continue to demonstrate subjective utility of Flue-cured and Burley fractions through POL tests on low tar regular and ART-based prototypes. Based on subjective results, a decision will be made regarding pilot or commercial scale-up of the process. Analytical characterization of fractions will continue.

POL testing on low tar regular and ART prototypes	3rd Qtr., 1990

4. Flavor Encapsulation -- Work on microencapsulation technology development for menthol will continue both inhouse and externally. Currently, plans are in progress for a visit to Southwest Research Institute to discuss technology development and pilot-scale capsule production. Extensive work is planned: (a) to reduce capsule size for direct application to tobacco and (b) to optimize menthol storage retention and delivery. Based on success of menthol work, further flavor applications of alginate-based microencapsulation technology may be evaluated.

Initial SWRI contact	February, 1990
Prototype SWRI menthol capsules	2nd Qtr., 1990

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III. **Resource Allocations**:

PROJECT GROUP	MAN-YEARS
Domestic Flavor Development (2304)	1.9
Applied Flavor Investigation (2305)	0.5
Basic Flavor Investigation (2307)	1.5
Other	0.3
TOTAL FLAVOR DEVELOPMENT PROJECTED, 1990	4.2
CURRENT, 1990	2.0
DIFFERENCE, PROJECTED VS CURRENT	2.2

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

RESTRICTED DISTRIBUTION

Richmond, Virginia

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OCT 10 1990
CLIFF LILLY

To: Dr. A. C. Lilly **Date:** 3 October 1990

From: A. H. Warfield and D. J. Ayers

Subject: TSNA Program Operational Plans for 1990.

OBJECTIVE(S): (1) To design a first generation laboratory model of a product by 1991 with MS TSNA (TSNA/mg TPM) delivery reduced 90% relative to the TPM-corrected TSNA delivery of a 1987 full-flavored, blended cigarette. (2) To design a second generation laboratory model of a product by 1993 with MS TSNA delivery (TSNA/mg TPM) delivery reduced 95% relative to the TPM-corrected TSNA delivery of a 1987 full-flavored, blended cigarette, utilizing technology based on a fundamental understanding of NA formation.

STRATEGIES:

REDUCTION OF MS TSNA BY REDUCING PREFORMED TSNA & PYROSYNTHETIC TSNA PRECURSORS IN FILLER

1. Reduce MS TSNA by selective removal of TSNA, amine precursors, and/or nitrosating agent precursors from filler.

2. Reduce MS TSNA by biochemical alteration(s) to tobacco leading to removal of alkaloid precursors of TSNA.

REDUCTION OF MS TSNA BY INHIBITING THE PYROSYNTHESIS OF TSNA

3. Reduce the levels of pyrosynthesized MS TSNA by incorporation into the cigarette design those aspects of oriental filler which result in an absence of significant TSNA pyrosynthesis from oriental tobacco.

4. Reduce the levels of pyrosynthesized MS TSNA by decreasing the reactivity to nitrosation of the amine precursors, or blocking reaction pathways which form nitrosating agents or which yield TSNA from the nitrosating agents.

REDUCTION OF MS TSNA BY ENHANCING DECOMPOSITION OF TSNA

5. Evaluate the enhancement of TSNA decomposition during smoking as a method for reducing TSNA delivery.

REDUCTION OF MS TSNA BY ALTERING PHYSICAL/CHEMICAL PARAMETERS OF CIGARETTES

6. Reduce the levels of pyrosynthesized MS TSNA by alterations in cigarette construction parameters.

7. Reduce the levels of pyrosynthesized MS TSNA by manipulation of filler salt content.

8. Reduce the levels of pyrosynthesized MS TSNA by manipulation of casings typically used in cigarettes but missing from the reference cigarette.

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TACTICS AND TIMETABLE:

1990

REDUCTION OF MS TSNA BY REMOVAL OF PREFORMED TSNA & TSNA PRECURSORS -

Selective Removal From Cured Filler Strategy:

Collaborate with ARD and PRD in development of SCFE methodology capable of removing minor alkaloids from filler:
- Prepare triethylamine bicarbonate and test for ability to enable extraction of nornicotine using hexane as solvent..... Nov. 1

Preparation of First Generation Low-TSNA Laboratory Model:
- Finish development of Low-TSNA BCR reconstituted material.... Nov. 15
- Incorporate Low-TSNA BCR reconstituted material into extracted blend and evaluate..... Nov. 30
- Add OrCEL to Low-TSNA blend and evaluate effect on MS TSNA... Dec. 15

Acquire appropriate additional data on these cigarettes..... Dec. 31

Biochemical Alterations to Tobacco Strategy:

Continue studies to confirm that the 60 kD band is PMT:
- Continue ^{3}H-SAM radiolabeling studies to label PMT:
  - Evaluate more sensitive methods for detecting label..... Dec. 31
  - Examine methods to optimize labeling..... Dec. 31
- Substrate specificity studies..... Nov. 1
- K_M Studies..... Dec. 1

Determine amino acid sequence of PMT:
- Evaluate methods for cleaving PMT to obtain additional sites for sequencing..... Dec. 31
- Generate sample for further sequencing..... Dec. 31

Use the sequence to design oligonucleotide probes and have these probes made..... Nov. 30

Use oligonucleotide probe to screen cDNA library..... begin Nov. 30

Initiate studies involving PCR to amplify the gene coding PMT.. begin Nov. 30

Develop methods for tobacco cell culture studies..... Dec, 31

Continue sequencing of overly expressed root clones..... as time permits

Continue to provide purified PMT preps..... as needed

Initiate experiments relevant to next alkaloid biogenesis pathway to be modified..... as time permits

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Amine Precursor Strategy:

Evaluate the role of unextracted nicotine (UN) in TSNA pyrosynthesis by the following:

- Optimize Nagarse Type VII enzyme digestions of Bu marc to separate Nic-Y and NN-Y from marc..... Dec. 31
- Write SOP for the determination of different forms of nicotine in tobacco and tobacco extracts..... Dec. 31
- Isolate >4 kD Nic-X and <4 kD Nic-X by GPC from hot water solubles (with 6912)..... Dec. 31
- Evaluate relationship between Nic-Y and MS NNK by determining Nic-Y and MS NNK in various water-extracted fillers..... Dec. 31

NNK precursor studies:

- Pseudooxynicotine (PsON) method:
  - Evaluate SIM for GC/MSD..... Nov. 30
  - Decision point for method..... Nov. 30
  - Complete development..... Dec. 31
- Develop plan to study existence of bound PsON, other bound TSNA precursors, and bound TSNA..... Oct. 30
- Develop plan to specifically address the reduction of NNK in tobacco..... Dec. 31

REDUCTION OF MS TSNA BY INHIBITING PYROSYNTHESIS

Oriental Inhibitor Strategy:

Complete evaluation of eight Or varieties:

- Data analysis using expert system software..... Dec. 15
- Document study (including recommendations)..... Dec. 31

Fractionate SC CO_2 Or filler extract to isolate potential inhibitor:

- Test fractions for inhibitory activity..... Nov. 30
- If active fractions present, identify active components..... Dec. 15
- Add Or inhibitor to Low-TSNA blend and evaluate..... Dec. 31

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ANALYTICAL METHODS DEVELOPMENT:

Develop new trapping system for aged/unaged SS smoke.....	Dec. 15
Check new batch of ^{14}C-NNN.....	when received
Investigate large Extrelut trap system for MS TSNA.....	Dec. 31
Investigate SPE method for smoke/filler TSNA workup.....	Dec. 31
Develop HPLC method (UV Vacancy Chromatog.) for nitrate/nitrite with lower limit of detection than currently available at PM R&D.....	as time permits

SUPPORT OF OTHER PROGRAMS:

Design and carry out study of effects of cigarette paper on nitrosamines in SS chamber.....	as time permits
Project ART support.....	ongoing
Support of other PM facilities.....	ongoing

1991

Selective Removal From Cured Filler Strategy:
Optimize first generation low-TSNA model for TSNA reduction (2nd q).

Attempt to incorporate any design parameters determined by CSBW Program (3rd q).

Formulate plans for refined first generation low-TSNA lab model based on use of a SCFE process designed to remove nicotine, preformed TSNA, and alkaloid precursors of TSNA (4th q).

Biochemical Alterations to Tobacco Strategy:
Develop MPO activity assay (1st q).

Begin purification of MPO (1st q).

Use oligonucleotide probe to identify PMT gene (1st and 2nd q).

Develop 2D gel analysis capabilities in-house (2nd q).

Use expression vectors to confirm the PMT gene (3rd q).

Make anti-sense construct of PMT gene (begin 4th q).

Prepare vector(s) for insertion of anti-sense constructs (begin 4th q).

Transform tobacco cells with anti-sense construct of PMT (begin 4th q).

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Amine Precursor Strategy:
Apply both forms of Nic-X to BW and evaluate as precursors for MS NNK (2nd q).

Identify Nic-X and Nic-Y (3rd q).

Develop smoke collection for analysis of PsON (2nd q).

Carry out a study of potential TSNA and their precursors which are chemically bound to soluble and insoluble tobacco components (3rd q).

Investigate removal of bound TSNA (if present) and their precursors by enzyme digestion followed by extraction (4th q).

Nitrosating Agent Strategy:
Initiate studies of role of NO and nicotine in combined gas stream to test for gas phase reaction & mechanism of NNK release (2nd q).

Develop methodology to test flash heating of TPM and filler to determine if TSNA precursors for pyrosynthetic type reactions are present in TPM and filler and to define time/temperature window for reaction (2nd q).

Test flash heating of TPM and filler to determine if TSNA precursors for pyrosynthetic type reactions are present in TPM and filler and to define time/temperature window for reaction (3rd q).

Finalize results from study on NO and nicotine in nitrosation and document (4th q).

Manipulation of Casings Strategy:
Plan and implement study to determine effect of casings typically used in cigarettes but missing from reference cigarettes (3rd q).

Support of Other Programs:
Project ART Support.

Support of other PM facilities.

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1992-1993

Amine Precursor, Nitrosating Agent, and Oriental Inhibitor Strategies:
Utilize enzyme treatment combined with extraction techniques to produce fillers yielding low MS TSNA. Incorporate pyrosynthesis inhibitors, NO scavengers, NNK pyrosynthesis inhibitors (if available) and antioxidants into the extracted fillers to yield a second generation low-TSNA model.

Biochemical Alterations to Tobacco Strategy:
Screen tobacco cells for reduced PMT and/or nicotine expression.

Regenerate transformed plantlets; select those with lowest nicotine.

Transform tobacco cells with anti-sense construct of MPO.

Support of Other Programs:
Support of PM facilities.

1994

Transfer technology for low TSNA model.

Biochemical Alterations to Tobacco Strategy:
Further develop and test transformed tobacco plants.

Support of Other Programs:
Support of PM facilities

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RESOURCE ALLOCATIONS FOR 1990:

How are the personnel assigned to this program allocated?
(These allocations are for personnel in the BCR Division)

	Professionals	Technicians
Extraction of preformed TSNA and TSNA Precursor Strategy:	1.20	0.50
Biochemical Alteration of Tobacco Strategy:	9.25	1.00
Oriental Inhibitor Strategy:	1.30	0.30
Amine Precursor Strategy:	2.40	0.50
Nitrosating Agent Strategy:	0.90	0.50
Cigarette Construction Parameters Strategy:	0.30	0.20
TOTAL	15.35	3.00

TRANSFER OF TECHNOLOGY:

The target date for the first generation laboratory model of a reduced TSNA product is 1991. An interim technology based primarily on lab-scale solvent extraction will be utilized until SCFE methodology capable of removing minor alkaloids (now being investigated) can be developed. When the latter has been accomplished, the corresponding technology will be transferred to Development. At that time, companion technologies involved in preparation of the low-TSNA filler can also be transferred to Development if deemed desirable.

ACKNOWLEDGMENTS:

The assistance of the following individuals in formulating the above plans is gratefully acknowledged: R. Cox, B. Davies, S. Davies, C. Ellis, S. Haut, W. Hempfling, C. Keene, R. Kinser, E. Lambert, J. Lyle, V. Malik, R. McCuen, R. Morgan, H. Nakatani, E. Southwick, M. Tickle, S. Wahab and T. Yu.

cc: Dr. R. A. Carchman
Dr. J. L. Charles
Dr. B. D. Davies
Dr. C. K. Ellis
Dr. W. P. Hempfling
Dr. R. W. McCuen
Dr. E. B. Sanders
Ms. R. D. Kinser

A D. Warfield
D J Ayers

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. C. K. Ellis Date: 20 September 1990

From: A. H. Warfield

Subject: Abstract of TSNA Program Presentation at the 3rd Quarter Planning Meeting

The program objective is to prepare model cigarettes with reduced delivery of MS TSNA. Organic solvent extracts of oriental filler were prepared and evaluated for inhibition of pyrosynthesis. There was no consistent reduction due to these extracts. A large scale SC CO_2 extract of oriental filler was prepared. This extract will be fractionated during 4th quarter, 1990, and the fractions tested for reduction of MS TSNA.

Pseudo-oxynicotine (PsON) and N-methylmyosmine (NMM) are potential precursors of MS NNK. Successful development of two methods for analysis of PsON was achieved. PsON added to a filler was detected in an extract by reduction followed by GC/MSD, or by direct GC/NPD or GC/MSD. Evidence for the presence of PsON was detected in several untreated fillers. In 4th quarter, 1990, selected ion monitoring will be evaluated for MSD, and the PsON method development will be completed. In 1991 methods will be developed to determine PsON in smoke. An attempt was made to remove MS NNK precursors by washing filler with aqueous solutions of various salts, acids, and bases. Water alone resulted in 30% reduction in NNK (without dry weight loss correction), and only ammonia and HCl (1-2N) provided any further reduction, but the best that could be achieved was 47%.

Two types of alkali-releasable bound nicotines have been determined to exist in filler, and these may be precursors of MS NNK. Water-soluble (Nic-X) and water-insoluble (Nic-Y) bound nicotines were analyzed in burley, bright and oriental fillers and base webs made from these fillers. Nic-Y levels from the three fillers paralleled the levels of MS NNK found when the correspondihg cigarettes were smoked: Bu>Br>Or. Enzymes were successfully used to cleave Nic-Y so that it could be made water soluble for evaluation and identification. In 4th quarter the enzyme digestion method will be optimized, followed by isolation of Nic-Y in soluble form. Nic-X was found to consist of two different materials differing in molecular weight: one is >4000 D, and the other is <4000 D. Evaluation of Nic-X and Nic-Y as precursors of MS NNK will be done in 4th quarter 1990. If a relationship is demonstrated, attempts will be made in 1991 to study the chemistry of Nic-X and Nic-Y.

To provide filler for a low-TSNA laboratory model cigarette, a blend of bright, burley and oriental fillers was extracted using our 95% ethanol process. Preformed TSNA, nicotine, and minor alkaloids were all reduced by 90% or better relative to the unextracted control. MS TSNA were reduced by 80% for NNN and NAT, and 60% for NNK. During 4th quarter, 1990, a low-TSNA BCR-RL will be developed for use in the low-TSNA laboratory model.

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To explore the use of SCFE for removal of minor alkaloids from tobacco, a series of experiments was conducted to evaluate the use of triethylamine (TEA) as a cosolvent for CO_2. Most of the experiments were carried out using hexane as a model for SC CO_2. It was demonstrated that 5% ethanol/hexane containing 3% TEA can be used to reduce nornicotine by ~60% if a cation exchange scrubber is used to provide a controlled removal of bases from the recycling solvent stream. Plans for 4th quarter call for use of a TEA salt to localize the effect of TEA and eliminate the need to provide ion exchange capacity for it in the scrubber. Further interaction with other Research Directorate divisions is planned in 1991 to further study the removal of minor alkaloids by SCFE.

CC: R. Kinser
Central File

A. L. Warfield

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: C. K. Ellis **Date:** September 24, 1990

From: D. J. Ayers

Subject: Summary Planning Meeting Presentation - Biochemical Approach to the Reduction of TSNA

The biochemical approach to the reduction of mainstream TSNAs involves the reduction of preformed TSNA in filler. The more immediate goal of this project is to prevent nicotine accumulation in leaves by selectively eliminating an enzyme necessary for nicotine synthesis in root. The enzyme that catalyses the first step in the conversion of putrescine to nicotine, putrescine N-methyl transferase (PMT), is reported to be the most important enzyme in the control of nicotine production and therefore was selected as the first enzyme to investigate. Hydroponically grown tobacco plants are topped and the roots harvested three days after topping. The proteins are extracted from the roots via ammonium sulfate precipitation. The ammonium sulfate fraction is then applied to a phenyl-Sepharose column and the partially purified enzyme is eluted. The fraction of eluent from the phenyl-Sepharose column that has PMT activity is then exposed to DEAE "pseudoaffinity" chromatography. The PMT enriched sample that is eluted from the column is then concentrated and exposed to isoelectric focusing. Using this procedure, a sample was generated and submitted for protein sequencing. The first attempt to sequence this protein was successful in yielding a sequence of the first several amino acids. Plans include the confirmation of the amino acid sequence as that of PMT, determining more of the amino acid sequence, initiating work directed towards the isolation of the gene coding for PMT, transforming plants with an anti-sense construct of the gene, and ultimately measuring PMT and nicotine levels in the transformed plant.

cc: R. Kinser
Central Files

D. J. Ayers

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

RESTRICTED DISTRIBUTION

Richmond, Virginia

To: Dr. A. C. Lilly Date: 12 February 1990

From: A. H. Warfield, R. D. Kinser and D. J. Ayers

Subject: TSNA Program Operational Plans for 1990.

OBJECTIVE(S): (1) To design a first generation laboratory model of a product by 1991 with MS TSNA (TSNA/mg TPM) delivery reduced 90% relative to the TPM-corrected TSNA delivery of a 1987 full-flavored, blended cigarette. (2) To design a second generation laboratory model of a product by 1993 with MS TSNA delivery (TSNA/mg TPM) delivery reduced 95% relative to the TPM-corrected TSNA delivery of a 1987 full-flavored, blended cigarette, utilizing technology based on a fundamental understanding of NA formation.

STRATEGIES:

REDUCTION OF MS TSNA BY REDUCING ENDOGENOUS TSNA & PYROSYNTHETIC TSNA PRECURSORS IN FILLER

1. Reduce MS TSNA by selective removal of TSNA, amine precursors, and/or nitrosating agent precursors from filler.

2. Reduce MS TSNA by biochemical alteration(s) to tobacco leading to removal of alkaloid precursors of TSNA.

REDUCTION OF MS TSNA BY INHIBITING THE PYROSYNTHESIS OF TSNA

3. Reduce the levels of pyrosynthesized MS TSNA by incorporation into the cigarette design those aspects of oriental filler which result in an absence of significant TSNA pyrosynthesis from oriental tobacco.

4. Reduce the levels of pyrosynthesized MS TSNA by decreasing the reactivity to nitrosation of the amine precursor(s), or blocking reaction pathways which form nitrosating agent(s) or which yield TSNA from the nitrosating agents.

REDUCTION OF MS TSNA BY ENHANCING DECOMPOSITION OF TSNA

5. Evaluate the enhancement of TSNA decomposition during smoking as a method for reducing TSNA delivery.

REDUCTION OF MS TSNA BY ALTERING PHYSICAL/CHEMICAL PARAMETERS OF CIGARETTES

6. Reduce the levels of pyrosynthesized MS TSNA by alterations in cigarette construction parameters.

7. Reduce the levels of pyrosynthesized MS TSNA by manipulation of filler salt content.

8. Reduce the levels of pyrosynthesized MS TSNA by manipulation of casings typically used in cigarettes but missing from the reference cigarette.

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TACTICS AND TIMETABLE:

1990

REDUCTION OF MS TSNA BY REMOVAL OF ENDOGENOUS TSNA & TSNA PRECURSORS

Selective Removal From Cured Filler Strategy:

Complete scale-up of current 95% EtOH extraction process to yield material for laboratory model:

- Reverse flow during extraction using large column..... Feb. 15
- Use smaller columns in series..... March 1
- Extract a blend instead of individual fillers..... March 15
- Investigate effect of extraction time..... April 1
- Plan aging study on solvent-extracted fillers..... April 1

Investigate additional means of removing UN from filler:

- Wash DBC Bu filler with dilute aqueous citric and mineral acid..... March 9
- Wash DBC Bu filler with $LaCl_3$ or other salts to remove Ca..... March 31
- Complete planning for additional modifications of fillers by aqueous washing..... March 31

Complete aging study and prepare report with recommendations for storage..... June 30

Collaborate with ARD and PRD in development of SCFE methodology capable of removing minor alkaloids from filler.. ongoing

Biochemical Alterations to Tobacco Strategy:

Continue ^{3}H-SAM radiolabeling studies to label PMT:

- Validate analysis methods..... Feb. 9
- Validate control experiments..... Feb. 16
- Label and analyze PMT samples..... March 16
- Evaluate company(s) offering 2D gel analysis to determine best replacement for Protein Databases Inc.... March 31
- Send labeled samples for 2D gel analysis..... March 31

Express overly expressed root clones in *E. coli* and assay for PMT activity from the *E. coli* cell extracts..... March 31

Provide PMT prep in amount and purity necessary for sequencing and send to outside vendor for sequencing..... June 30

Initiate tobacco cell culture studies..... July 1

Develop manual DNA sequencing methodologies in-house..... July 31

Have defined oligonucleotide probes of PMT to be synthesized..... Sept. 30

Develop 2D gel analysis capabilities in-house..... Sept. 30

Sequence overly expressed root clones..... Oct. 31

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Initiate screening of cDNA library from root with oligonucleotide probes to identify PMT..... Dec. 31

Compare DNA sequences obtained in-house with other reported sequences using computer programs..... Dec. 31

Continue protein purification methods development in house..... ongoing

Continue to obtain PMT samples processed from the ammoniumn sulfate stage through the phenyl-Sepharose and DEAE "affinity" mode..... ongoing

Continue to provide purified PMT preps, as needed..... ongoing

Purify selected tobacco enzymes, as needed..... ongoing

Continue appropriate tobacco biochemistry studies..... ongoing

Continue biochemical alterations studies..... ongoing

Continue experiments relevant to next alkaloid biogenesis pathway to be modified..... ongoing

Amine Precursor Strategy:

Evaluate the role of unextracted nicotine (UN) in TSNA pyrosynthesis by the following:

Enzyme digestions of Bu marc after water extraction to separate Nic-Y and NN-Y from marc..... initiate Feb. 15

Write SOP for the determination of different forms of nicotine in tobacco and tobacco extracts..... March 1

Isolate >4 kD Nic-X and <4 kD Nic-X by GPC from hot water solubles (with 6912)..... initiate March 15

Determine TSNA in filler and smoke of SCFE Br, Bu and Or and the BWs from extracted fillers..... April 30

Determine time course of Nic-Y and NN-Y development in green, dry, and cured Bu tobacco..... June 30

Apply Nic-X and Nic-Y to BWs and evaluate as precursors for MS NNK..... Dec. 31

Identification of Nic-X and Nic-Y..... Dec. 31

Exploratory ^{13}C alkaloid tracer studies for unextracted precursors..... Dec. 31

Investigate appropriate fillers for unextracted alkaloids. ongoing

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Investigate proximate NNK precursor:

Develop plan for studying effect of nicotine oxidation products on TSNA pyrosynthesis in MS/SS smoke..... Feb. 15

Develop derivatization/HPLC method for pseudooxynicotine and other secondary amines..... Mar. 15

Add nicotone to filler and evaluate its effect on NNK formation..... March 31

Apply derivatization method to filler and smoke..... May 30

Develop plan to specifically address the reduction of NNK in tobacco..... June 30

REDUCTION OF MS TSNA BY INHIBITING PYROSYNTHESIS

Oriental Inhibitor Strategy:

Complete evaluation of eight Or varieties:

Data analysis using expert system software..... June 30

Document study (including recommendations)..... Aug. 31

Extraction of Or filler to isolate potential inhibitor:

Test SCF extract for inhibitory activity..... Feb. 15

Test fractions for inhibitory activity..... March 15

If active fractions present, identify active components..... May 7

Add Or inhibitor + antioxidant to low TSNA filler..... Aug. 31

Smoke above to determine effect on MS TSNA..... Sept. 30

Plan study to develop a BCR-reconstituted material (with reduced TSNA delivery)..... March 31

Complete study and have the modified BCR-reconstituted material made in Pilot Plant..... Aug. 31

Nitrosating Agent Strategy:

Initate studies of role of NO and nicotine in combined gas stream to test for gas phase reaction & mechanism of NNK release.... March 31

Determine effect of diene release compounds on TSNA delivery:

Complete MS evaluation of diene release compound as NO scavanger..... April 30

Carry out selected reactions of sugars with ammonia and/or amino acids in order to evaluate reaction products as scavengers of nitrosating agents during smoking:

Test various sugar-derived materials as nitrosating agent scavangers/pyrosynthesis inhibitors

-Complete MS evaluation of proline-Amadori cmpd..... May 31

-Reevaluate & determine future direction of approach. June 30

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Develop methodology to test flash heating of TPM and filler to determine if TSNA precursors for pyrosynthetic type reactions are present in TPM and filler and to define time/temperature window for reaction..... June 30

Test flash heating of TPM and filler to determine if TSNA precursors for pyrosynthetic type reactions are present in TPM and filler and to define time/temperature window for reaction..... Sept. 30

Finalize results from study on NO and NIC in nitrosation and document..... Sept. 30

Continue studies of nitrosation agent scavengers (evaluate reaction products as scavengers of nitrosating agents during smoking)..... ongoing

ALTERATION OF PHYSICAL/CHEMICAL PARAMETERS

Evaluate effect of paper porosity and packing density:
Carry out remainder of study..... Oct. 31
Use data obtained to design best cigarette construction for use in blended low TSNA product..... Dec. 31

PREPARATION OF FIRST GENERATION LOW-TSNA LABORATORY MODEL

Add ASC, sugars to blend of Or with extracted Bu & Br and evaluate effect on MS TSNA..... Jan. 15

Add OrCEL to blend of Or with extracted Bu & Br and evaluate effect on MS TSNA..... Feb. 28

Incorporate Low TSNA BCR reconstituted material into the above blend and evaluate..... Nov. 30

Determine MS TSNA on experimental filler modified as above..... Dec. 15

Request S/M assay on smoke from these cigarettes..... Dec. 31

Submit above for small scale subjectives..... Dec. 31

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ANALYTICAL METHODS DEVELOPMENT:

Evaluate the currently used SS chamber smoke collection method for artifactual NA formation and develop alternate smoke collection system if necessary.....	initiate March 31
Develop HPLC method (UV Vacancy Chromatog.) for nitrate/nitrite with lower limit of detection than currently available at PM R&D.....	as time permits
Develop SPE method for smoke TSNA workup.....	as time permits

SUPPORT OF OTHER PROGRAMS:

Design and carry out study of effects of cigarette paper on nitrosamines in SS chamber.....	May 31
Project ART support.....	ongoing
Support of other PM facilities.....	ongoing

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1991

Selective Removal From Cured Filler Strategy:
Optimize first generation low-TSNA model for TSNA reduction.

Attempt to incorporate design parameters determined by CSBW Program.

Formulate plans for refined first generation low-TSNA lab model based on use of a SCFE process designed to remove nicotine, endogenous TSNA, and alkaloid precursors of TSNA.

Biochemical Alterations to Tobacco Strategy:
Prepare anti-sense DNA constructs.

Prepare vector(s) for insertion of anti-sense constructs.

Transform tobacco leaf tissue, cells and protoplasts.

Regenerate transformed plantlets; select individuals with lowest nicotine.

Manipulation of Casings Strategy:
Plan and implement study to determine effect of casings typically used in cigarettes but missing from reference cigarettes.

Support of Other Programs:
Project ART Support.

Support of other PM facilities.

1992-1993

Amine Precursor, Nitrosating Agent, and Oriental Inhibitor Strategies:
Incorporate pyrosynthesis inhibitors, NO scavengers, NNK pyrosynthesis inhibitors (if available) into the first generation low-TSNA model to yield a second generation low-TSNA model.

Biochemical Alterations to Tobacco Strategy:
Further develop and test transformed tobacco plants.

Support of Other Programs:
Support of PM facilities.

1994

Transfer technology for low TSNA model.

Support of Other Programs:
Support of PM facilities

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RESOURCE ALLOCATIONS FOR 1990:

How are the personnel assigned to this program allocated?
(These allocations are for personnel in the BCR Division)

	Professionals	Technicians
Extraction of Endogenous TSNA and TSNA Precursor Strategy:	1.20	0.50
Biochemical Alteration of Tobacco Strategy:	9.25	1.00
Oriental Inhibitor Strategy:	1.30	0.30
Amine Precursor Strategy:	2.40	0.50
Nitrosating Agent Strategy:	0.90	0.50
Cigarette Construction Parameters Strategy:	0.30	0.20
TOTAL	15.35	3.00

TRANSFER OF TECHNOLOGY:

The target date for the first generation laboratory model of a reduced TSNA product is 1991. An interim technology based primarily on lab-scale solvent extraction may have to be utilized until SCFE methodology capable of removing minor alkaloids (now being investigated) can be developed. When the latter has been accomplished, the corresponding technology will be transferred to Development. At that time, companion technologies involved in preparation of the low-TSNA filler can also be transferred to Development if deemed desirable.

ACKNOWLEDGMENTS:

The assistance of the following individuals in formulating the above plans is gratefully acknowledged: B. Davies, S. Davies, C. Ellis, S. Haut, W. Hempfling, C. Keene, E. Lambert, J. Lyle, V. Malik, R. McCuen, R. Morgan, H. Nakatani, E. Southwick, M. Tickle, S. Wahab and T. Yu.

cc: Dr. R. A. Carchman
Dr. J. L. Charles
Dr. B. D. Davies
Dr. C. K. Ellis
Dr. W. P. Hempfling
Dr. R. W. McCuen
Dr. E. B. Sanders

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: C. Ellis **Date:** September 21, 1990

From: R. McCuen

Subject: **Abstract of Planning Meeting Presentation - September 17, 1990**

Dr. McCuen presented the Lowered Biological (LBA) Program - the first such presentation since March of 1989. The objective and strategies for this effort remained unchanged - to reduce the biological activity of CSC by 90% in at least one ***in vitro*** bioassay.

Dr. McCuen covered the bioassay development major strategy by focusing on the EGF binding, JB6 cell transformation and glutathione depletion assays. The EGF system was shown to respond to catechol. Removal of catechol from CSC was accomplished with the enzyme catechol oxidase. While enzyme-treated CSC did enhance EGF binding (a positive finding) so did heat inactivated enzyme-treated CSC and enzyme alone. The latter two results made interpretation of the first result very difficult. With the JB6 cell transformation system which was established at PM using TPA, a positive response has not been obtained with CSC. This was despite examination of several variables in the assay - serum supplier/concentration, source of water, length of treatment time, etc. The GDA which does respond to CSC has not been used to any great extent to evaluate models. This is because we have been unable to show the biological relevance of a CSC glutathione depleted cell versus a non-depleted cell. In other words, mutagenicity in GSH depleted ***Salmonella*** or V79 cells was no greater than in cells which had not been depleted of GSH.

In the model development and evaluation major strategy, Dr. McCuen discussed a variety of attempts to manipulate burley tobacco solubles to lower S/M bioactivity. Of the experiments conducted - calcium acetate, sugars (glucose/fructose/sucrose), amino acids (lysine/proline/arginine), hydrogen peroxide and chelation using silver nitrate - only the chelation efforts were successful in reducing biological activity by about 55% versus a suitable control. Two ongoing studies are part of this strategy. The first was a hollow fiber membrane ultrafiltration of burley solubles to remove materials based on molecular weight. The experiments have been done and the cigarettes made; however, the biological activity has yet to be determined. The second study used electrodialysis to remove ions of interest from the burley solubles. Initial attempts have focused on nitrate removal (which was successful) and then an add-back of different nitrogen sources to ascertain how they affect biological activity.

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PM has one bioassay (S/M) that measures initiating type compounds in CSC. No *in vitro* assay specific for promoters in CSC has been found. In an attempt to lower the bioactivity of burley tobacco solubles as measured in the S/M assay, only two methods have been successful - strong cation exchange column chromatography (70% reduction) and chelation with silver nitrate (55% reduction).

During the course of his presentation, several questions were fielded from the attendees, some of which are summarized below.

Walter Hempfling suggested that catechol oxidase could be immobilized on a support and used in a column mode with CSC. This should reduce the EGF binding enhancers apparently present in the enzyme preparation from getting into the CSC. This idea will be tested.

Richard Carchman suggested that the residual glutathione levels (~30% of the starting concentration) in the microbial or mammalian cells following depletion may be enough to protect the cell against a mutagenic insult. This is reasonable, but the assay is being conducted that the maximum limit of depletion and mutation so as to avoid toxicity. A dead cell does not respond to either parameter measured. Richard also wanted to know if in the EGF binding experiments where enhancement was observed was the enhancement due to an increased number of EGF receptor sites or an increased affinity of the receptor for the ligand. Maybe these analyses would distinguish among the kinds of increased EGF binding observed for catechol-depleted CSC, heat-inactivated catechol-depleted CSC and when the enzyme was tested alone.

Andy Kallianos was interested in the successful CSBW remake and whether the burley solubles obtained via centrifugation of BuCEL were similar (chemical/biological activity). This is currently being examined to determine the effect of storage time on burley solubles.

Ken Houghton queried as to the chemical differences between impaction trapped CSC and cold trapped CSC as the different trapping methods may be affecting the lack of response in the JB6 cell transformation system. John Lephardt indicated there were some differences in the nitrogen-containing compounds such as the nitroarylamines.

/mps

Bob McCrea

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: .Dr. A. C. Lilly Date: February 13, 1990

From: .Dr. G. J. Patskan

Subject: .Operational Plans for the Lowered Biological Activity Program - 1990

I. OBJECTIVE

To decrease the activity of cigarette smoke condensate (CSC) by 90%, relative to 2R1 CSC, as determined by multiple in vitro assays.

II. STRATEGIES

1. Bioassay Development: Establish in vitro bioassays which can differentiate among CSCs from various model cigarettes.

2. Model Development: Prepare model cigarettes designed to reduce biological activity.

3. Model Evaluation: Test CSC from new model cigarettes.

4. Model Optimization: Improve the subjectives of a low activity model.

5. Information Survey: Gather information from the outside scientific community relevant to biological activity.

III. TACTICS AND TIMETABLE

A. BIOASSAY DEVELOPMENT

1. Epidermal Growth Factor (EGF) Binding Assay

a. Status: Arachidonic acid metabolism does not appear to be involved in the reduction of EGF binding caused by CSC. Preliminary experiments investigating the effect of down regulation of protein kinase C on the response to CSC were conducted. The chromatographic removal of catechol from CSC was determined to be too non-selective.

b. Plans:

1. Complete experiments evaluating the effects of down regulation of protein kinase C on the response to CSC (1st Quarter, 1990).

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2. Evaluate the ability of catechol oxidase to degrade catechol in a CSC solution (1st Quarter, 1990).

   a. If the enzymatic degradation of catechol is effective, test the catechol-depleted CSC in the EGF binding assay (2nd Quarter, 1990).

   b. If the enzymatic degradation of catechol is not effective, this work will be discontinued.

3. Determine the effects of CSC on the specific activity of ATP in 3T3 cells in preparation for phosphorylation studies (1st and 2nd Quarters, 1990).

4. Determine the effects of CSC on EGF receptor phosphorylation (2nd and 3rd Quarters, 1990).

2. Phorbol Dibutyrate (PDBu) Binding Assay

   a. Status:

      The assay was not able to distinguish between CSCs following treatment at 37°C or 4°C.

   b. Plans:

      1. The assay will be discontinued and a completion report written (1st Quarter, 1990).

3. JB-6 Transformation Assay

   a. Status:

      TPA, a known tumor promoter, induced the formation of colonies in soft agar.

   b. Plans:

      1. Test the effects of pure compounds which are known to be tumor promoters or are known to be inactive as tumor promoters (1st Quarter, 1990).

      2. Test the response to 2R1 CSC (2nd Quarter, 1990).

      3. a. If 2R1 CSC is active in the standard assay, evaluate the effects of other CSCs (3rd and 4th Quarters, 1990).

      3. b. If 2R1 CSC is not active in the standard assay, explore modifications to the assay which may yield a positive response from 2R1 CSC (3rd Quarter, 1990).

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4. Glutathione Depletion Assay (GDA)

a. Status:

Results from experiments with inhibitors of arachidonic acid metabolism were inconclusive.

b. Plans:

1. Determine the relevance of glutathione depletion by CSC in V79 cells using a V79 mutation assay (1st and 2nd Quarters, 1990).

2. a. If the relevance of glutathione depletion is established, then conduct the GDA as a model evaluation tool (3rd and 4th Quarters, 1990).

2. b. If the relevance of glutathione depletion is not established, then direct effort toward other areas of bioassay development (3rd and 4th Quarters, 1990).

B. MODEL DEVELOPMENT

1. Crossed Solubles/Base Web Study

a. Status:

Cigarettes have been prepared from the new feedstocks. A sample of BuCEL low in many components was prepared using electrodialysis. BuCEL was treated with several chelating agents including silver nitrate.

b. Plans:

1. Prepare BuCEL solubles fraction (S1) from new BuCEL and determine the effect of centrifugation conditions (1st Quarter, 1990).

2. Investigate various treatments of BuS1 including: hydrogen peroxide to oxidize amines and irradiation with uv and/or X-rays (1st Quarter, 1990).

3. Evaluate S1 and insolubles fractions from Bu, Br, and Or CELs (1st Quarter, 1990).

4. Complete study of silver nitrate precipitation of components from BuS1 (1st Quarter, 1990).

5. Explore molecular weight separation of BuS1 by hollow fiber ultrafiltration (2nd Quarter, 1990).

6. Consider alternative methods of denitrification for these studies (2nd Quarter, 1990).

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7. Provide ninhydrin reactive materials analytical capability (2nd Quarter, 1990).

8. Denitrate BuS1 by electrodialysis (2nd Quarter, 1990).

9. Determine effects of nitrogenous compounds (ammonium salts, standard protein and amino acid mixtures) (2nd Quarter, 1990).

10. Complete study of amino acids and/or sugars (2nd Quarter, 1990).

11. Evaluate the effect of nitrate by adding nitrate to denitrated tobacco solubles (3rd Quarter, 1990).

12. Study precursor/product relationships for S/M activity by addition of appropriate material to electrodialyzed substrate (3rd Quarter, 1990).

13. Evaluate effect of enzyme treatment of BuS1 (4th Quarter, 1990).

14. Complete written report of chemical studies (4th Quarter, 1990).

C. MODEL EVALUATION

1. Salmonella/microsome Assay

a. Status:

CSC from cigarettes prepared with an electrodialyzed sample of BuCEL low in many components on BrBW was low in S/M activity. CSC from cigarettes prepared with silver nitrate-treated BuCEL on BrBW had lower activity than the control.

b. Plans:

1. Substantiate, with more data, the possible change of assay SOP involving storage of CSC dilutions at -80°C (1st Quarter, 1990).

2. Evaluate submitted samples (ongoing).

3. Evaluate samples from Model Development studies (ongoing).

D. MODEL OPTIMIZATION

Laboratory investigations will commence following the development of a model with lowered biological activity.

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IV. RESOURCE ALLOCATIONS (1990)

BIOASSAY DEVELOPMENT:

EGF Assay

D. Stagg (100%)
B. Vaughan (25%)
T. Burruss (20%)
G. Patskan (30%)

PDBu Assay

T. Burruss (10%)
G. Patskan (15%)

JB-6 Transformation

G. Nixon (100%)
T. Burruss (40%)
B. Vaughan (60%)
G. Patskan (20%)

Glutathione Depletion Assay

W. McCoy (100%)
B. Vaughan (15%)
T. Burruss (30%)
G. Patskan (20%)

MODEL DEVELOPMENT:

Crossed Solubles/Base Web Study

S. Hassam (100%)
S. Drew (100%)
R. Hellams (60%)
N. McGee (30%)
R. Izac (100%)
G. Patskan (5%)
R. Kinser (10%)
R. McCuen (10%)

MODEL EVALUATION:

Salmonella/microsome Assay

L. Thompson (100%)
R. Jones (100%)
N. Thompson (10%)
O. Gaines (10%)
G. Patskan (10%)
R. McCuen (10%)

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Smoke and Sample Preparation

R. Hellams (30%)
N. McGee (60%)
R. Kinser (5%)

V. LONG RANGE PLANS (1991-1994)

These plans are dependent on: (1) the status on ongoing research; (2) new information, and (3) the availability of resources.

A. BIOASSAY DEVELOPMENT

1991:
1. Develop biochemical assays for JB6 cells.
2. Begin work to develop a mouse "skin" culture system.
3. Establish a protein kinase C assay.

1992:
1. Continue the development of a mouse "skin" culture system.
2. Evaluate possible uses for flow cytometry.

1993:
1. Determine the effects of CSC on the biology of the mouse "skin" culture.
2. Conduct pilot studies using flow cytometry in outside laboratories.

1994:
1. Determine the effects of CSC on the biochemistry of the mouse "skin" culture.
2. Establish flow cytometry capability.

1991-1994: Based on the current information the following topics are also being considered: a cell proliferation assay; an assay based on markers of epithelial differentiation; an intracellular calcium assay; an oncogene assay; a new cell transformation assay; and a free radical assay.

B. MODEL DEVELOPMENT

1991:
1. Evaluate membrane extraction methods.
2. Continue add-back studies.
3. Continue evaluation of precipitation methods.
4. Continue evaluation of alternate methods of denitrification.

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5. Continue selective electrodialysis.

6. Identification of precursor components.

7. Evaluate effects of cigarette construction.

1992:

1. Evaluate modified supercritical fluid extraction.

2. Continue evaluation of membrane technology.

3. Evaluate enzyme methods for modification of CEL.

4. Continue selective electrodialysis.

5. Continue identification of precursor components.

6. Continue add-back studies.

7. Evaluate effects of cigarette construction.

1993:

1. Continue add-back studies.

2. Start evaluation of scale-up methods.

3. Continue evaluation of membrane technology.

4. Continue identification of precursor components.

5. Evaluate effects of cigarette construction.

1994:

1. Continue to evaluate scale-up methods.

2. Continue identification of precursor components.

1991-1994: Determine the chemical identity of CSC components responsible for biological activity in new bioassays.

C. MODEL EVALUATION

1991-1994:

1. Continue to evaluate CSC from new model cigarettes using the Salmonella/microsome assay.

2. Evaluate CSC from model cigarettes using new bioassays as they become available.

D. MODEL OPTIMIZATION

Laboratory investigations will commence following the development of a model with lowered biological activity.

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VI. RESOURCE ALLOCATIONS, LONG RANGE (1991-1994)

BIOASSAY DEVELOPMENT:

1991: 3 professionals, 3 technicians
1992: 3 professionals, 3 technicians
1993: 4 professionals, 4 technicians
1994: 4 professionals, 4 technicians

MODEL DEVELOPMENT:

1991: 4 professionals, 1 technician
1992: 4 professionals, 1 technician
1993: 4 professionals, 1 technician
1994: 4 professionals, 1 technician

MODEL EVALUATION:

1991: 1 professional, 1.2 technicians
1992: 2 professionals, 2 technicians
1993: 2 professionals, 2 technicians
1994: 2 professionals, 2 technicians

VII. TECHNOLOGY TRANSFER

Selected processes which result in acceptable new model cigarettes will be transferred to the Pilot Plant.

cc: R. Carchman
J. Charles
C. Ellis
O. Gaines
W. Hempfling
R. Jones
R. Kinser
R. McCuen
L. Thompson
N. Thompson
Project 6906
Project 6912

D. F. Parker

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ABSTRACT
New Expanded Tobacco Program
September, 1990 Planning Meeting

The objectives of the New Expanded Tobacco Program are to: 1) develop an expanded tobacco material having more "tobacco-like" subjectives, 2) reduce degradation to allow for improved product quality and better yield, and 3) reduce CO_2 emissions as compared to DIET. The development work is being aggressively pursued so that the planned ET expansions in Cabarrus and BOZ, Holland can benefit from as much new technology as their schedules will allow. Priority is being given to defining a batch gas impregnation/expansion system which will improve product thermal treatment uniformity and reduce degradation. This work is targeted for completion by the end of 1990 so that the process improvements can be included in the design of the planned DIET line addition at Cabarrus.

Development of a continuous gas impregnation/expansion system is also being aggressively pursued to further enhance the operational requirements and product benefits associated with the new expansion process. Plans are to establish a continuous impregnation/expansion pilot test system in July, 1991 and complete the definition of the process by the end of 1991.

Major developmental issues consist of: 1) determining the tobacco preparation requirements, 2) defining the gas impregnation process conditions, 3) designing the continuous gas impregnation process equipment, 4) determining the thermal processing requirements and 5) designing the thermal treatment equipment.

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

RECEIVED
JUL 2 5 1990
CLIFF LILLY

To: Mr. Ed Craze

Date: July 17, 1990

From: W. Winterson

Subject: New Expanded Tobacco Program Objectives and Plans

Attached are detailed plans and objectives for the New Expanded Tobacco program. The plans consist of an overview, followed by separate detailed plans for the four distinct project areas which make up the program. These areas are:

Partial Expansion of Tobacco with Existing DIET Process Equipment

Alternate Processes for Partial Expansion of Tobacco

Alternate Impregnation Processes

Alternate Puff/Dry/Set Processes.

Work being done outside Process Development to resolve the mechanisms of the expansion process are included within the individual detailed plans.

This program takes a fresh look at the process of expanding tobacco. It will identify the advantages and disadvantages of alternate means of producing expanded tobacco, from partially expanding additional blend components in the present or a new process, to development of a completely new process which maintains more of the subjective characteristics of the tobacco feed while providing equal or improved physical characteristics.

The plans attached represent the team's best guess at this time as to how this work will proceed.

cc: H. Burnley
Project 1812 Staff

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NEW EXPANDED TOBACCO PROGRAM

OBJECTIVES AND PLANS

JULY, 1990

2021554152

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NEW EXPANDED TOBACCO PROGRAM

Mission Statement

Develop tobacco expansion technology and associated processing for the production of expanded tobacco materials having the physical and subjective characteristics required to support future product needs. The processes will be developed in accordance with sound environmental practice.

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New Expanded Tobacco Program

Project Statements

Four distinct project areas have been established to accomplish the mission of the New Expanded Tobacco program. These are identified by the Project Statements below.

Partial Expansion of Tobacco with Existing DIET Process Equipment:

Develop processing schemes to produce partially expanded tobacco with existing DIET process equipment for inclusion in cigarette blends, which will reduce cigarette density to 0.18 g/cc while maintaining subjective and physical characteristics.

Alternate Processes for Partial Expansion of Tobacco:

Develop and evaluate processing alternatives to the DIET process to produce partially expanded tobacco for inclusion in cigarette blends, which will reduce cigarette density to 0.18 g/cc while maintaining physical and subjective characteristics.

Alternate Impregnation Processes:

Develop alternate impregnation processes to improve the subjectives of expanded tobacco while maintaining equivalent cigarette filling power to the existing process. Develop a continuous impregnation process.

Alternate Puff/Dry/Set Techniques:

Define alternate means of puffing, drying, setting and reordering impregnated tobacco which will improve product subjectives and physical characteristics relative to the present DIET process.

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Objectives

For each aspect of the New Expanded Tobacco Program, objectives have been developed by the engineers involved. These are summarized on the following Gantt chart, and attached to this plan. Additionally, support groups, primarily Physical Research, have developed plans for work on this program. These are incorporated in the four detailed plans, and are also attached.

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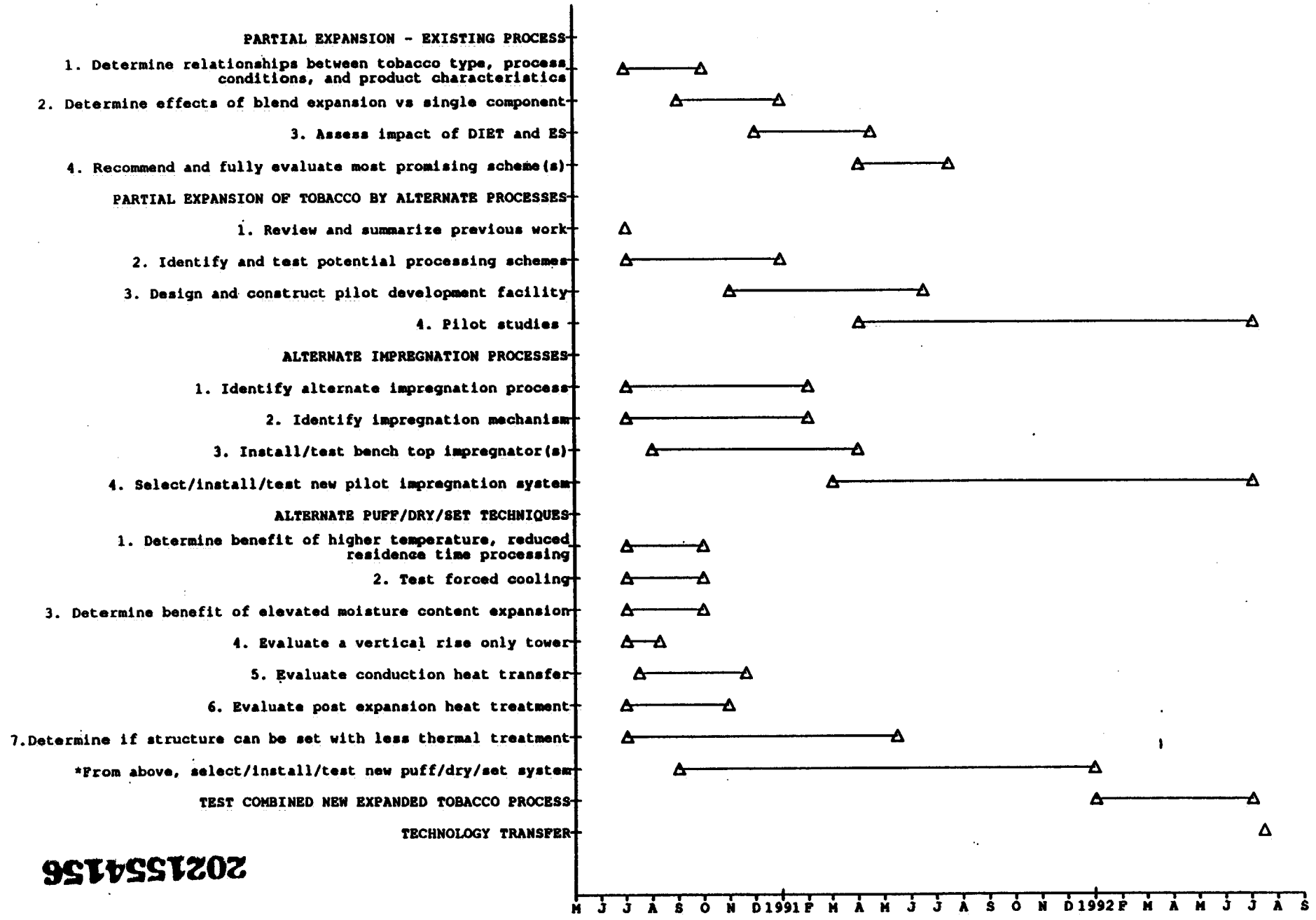
New Expanded Tobacco Program



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Detailed Objectives and Plans

The following detailed objectives and plans for the New Expanded Tobacco program were developed in June, 1990. Authors include:

Partial Expansion - Existing DIET Process	D. Donaher
Partial Expansion - Alternative Processes	D. Donaher
Alternate Impregnation Process	K. H. Cho
Alternate Puff/Dry/Set Techniques	W. Winterson
Physical Research Support Programs	T. Howell J. Banyasz

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Partial Expansion

with Existing DIET Process Equipment

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DRD
6/21/90

Program Plans - Partial Expansion of Tobacco with Existing DIET Process Equipment

Project Statement

Develop processing schemes to produce partially expanded tobacco with existing DIET process equipment for inclusion in cigarette blends, which will reduce cigarette density to 0.18 g/cc while maintaining subjective and physical characteristics.

Project Objectives

For all Philip Morris brands, determine acceptable combinations of expansion feedstock and tower processing conditions to meet the criteria of the project statement and evaluate their economic impact as outlined below.

1. Determine the relationship between tower operating conditions (temperature, tobacco feed rate, gas composition, gas velocity) and subjective/physical properties for each tobacco type (bright, burley, oriental).

2. Compare the effect of blend expansion in various combinations with the expansion of individual blend components on subjective/physical properties.

3. Determine the contribution of DIET and ES components to subjective/physical properties both as standard expanded products and as included in partial expansion.

4. Analyze blend similarities and production requirements for all brands.

5. Propose one or more processing schemes for detailed physical, chemical, subjective, and economic evaluation.

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Background

Over the past year, several groups including Product Development and the Leaf Blending Group have evaluated "partial expansion" as a means to reduce tobacco density in the cigarette while maintaining the subjective and physical properties. This previous work has been done by evaluating various tobaccos that were impregnated and expanded using the existing DIET process. Partial expansion was achieved by using tower temperatures in the range of 350 - 450 °F. Several successful cigarette models were achieved, however, the emphasis during the development was mostly on tobacco blend/cigarette design. Therefore, this program was initiated to assess and develop the potential for partial expansion from a processing standpoint.

Program Plans

In order to achieve the program objectives, outlined below is the proposed testing scheme. Standard impregnation at 400 psi and tobacco OV of 21% OV will be used. Changing these parameters requires major modification or the addition of new equipment to the existing DIET process and therefore falls under the scope of a different program.

I. Determine Fundamental Relationships

A. Assess the effect of tobacco type
   1. DBC Bright
   2. DBC Burley
   3. Oriental
   4. Total Marlboro blend

B. Determine the effect of processing conditions
   1. Tower temperature
   2. Tower gas velocity
   3. Tobacco feed rate through tower
   4. Soak time
   5. Residence time (standard tangential vs. plug flow tangential)

C. Evaluate/Characterize products
   1. SV
   2. Equilibrated CV/OV
   3. Chemical Analysis
   4. Subjective screening

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II. Determine the Effect of Blend Expansion

A. Apply information from fundamental studies to predict results

B. Assess the effect of blend type
   1. DBC bright and DBC burley
   2. DBC bright and Oriental
   3. Oriental and DBC burley
   4. DBC bright, burley and Oriental
   5. Total Marlboro blend

C. Assess the effect of process conditions
   1. As determined from fundamental studies

D. Evaluate Products
   1. SV
   2. Equilibrated CV/OV
   3. Chemical analysis
   4. Subjective evaluation in blends
   5. Cigarette physical/smoke evaluation of selected blends

E. Compare results to individually expanded materials that are blended together

III. Assess the Contribution of DIET and ES

A. Choose several models (blend and process conditions) from previous studies

B. Add back DIET bright feedstock and ES feedstock (CRS) to the blend before partial expansion

C. Evaluate blends
   1. Blend equilibrated CV/OV
   2. Chemical analysis
   3. Detailed subjective evaluation
   4. Detailed physical/smoke evaluation of cigarettes

D. Compare results to same blends but with standard DIET and ESB added

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All testing during the first three phases will use tobacco cased with standard DETA casing. The addition of more traditional blend casings will be addressed only under the detailed final evaluation of one or more processing schemes.

IV. Recommend and Evaluate the most promising scheme(s)

A. Evaluate blend similarities for all brands

B. Assess production requirements for all brands

C. Assess the effect of casings on subjective, physical, and chemical properties

D. Detail and evaluate potential processing concerns in a manufacturing environment for each scheme
   1. Blending
   2. Casings

E. Conduct complete physical, chemical, smoke, and subjective characterization with assistance from Product Development

Timescales

Outlined below is a detailed timescale for completion of the program broken down by each of the development phases previously discussed. The estimated completion dates for the various tasks assumes 2 days/week testing time on the Phase III (8" tower) DIET system. In addition, it has been assumed that standard technician support for pulling/submitting samples and running sieves will be available from the D Pilot Plant Technicians.
Gantt charts for the program schedule are attached.

I. Determine Fundamental Relationships

• test design	June 1990
• testing	July-August 1990
• subjective screening	August 1990
• data evaluation	August-September 1990

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Timescales (cont'd)

II. Determine the Effect of Blend Expansion

•test design	September 1990
•testing	October 1990
•cigarette preparation/physical evaluation	November 1990
•subjective evaluation	November 1990
•data evaluation	December 1990

III. Assess the Contribution of DIET and ES

•test design	December 1990
•testing	January 1991
•cigarette preparation	February 1991
•cig. physical/smoke evaluation	February-March 1991
•detailed subjective evaluation	February-April 1991
•data evaluation	March-April 1991

IV. Recommend and Evaluate the most promising scheme(s)

•evaluation of blends/production reqmts.	ongoing
•assess effect of casings	April 1991
•detail/evaluate processing concerns	April-May 1991
•final characterization of recommended schemes	May-June 1991
•final report	July 1991

Resource Requirements

Semiworks Primary:	•Blend preparation of approximately 30 small scale blends •Blend preparation of approximately 20 large scale blends
Semiworks Make/Pack:	•Cigarette making of approximately 60 models
Materials Evaluation:	•Physical evaluation of the above blends and cigarettes •CV and OV analysis of DIET process runs
Cigarette Testing:	•Smoke analysis of the above cigarettes

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Resource Requirements (cont'd)

Analytical:	• Chemical analysis on approximately 75 samples
Technician Support:	• Assistance in completing sieve and SV analysis and in sampling • Assistance in coordinating blends/cigarettes thru Semiworks
Flavor Development:	• Assistance in identifying and addressing subjective concerns
Leaf Blending Group:	• Assistance in subjective characterization
NET panel:	• Subjective screening

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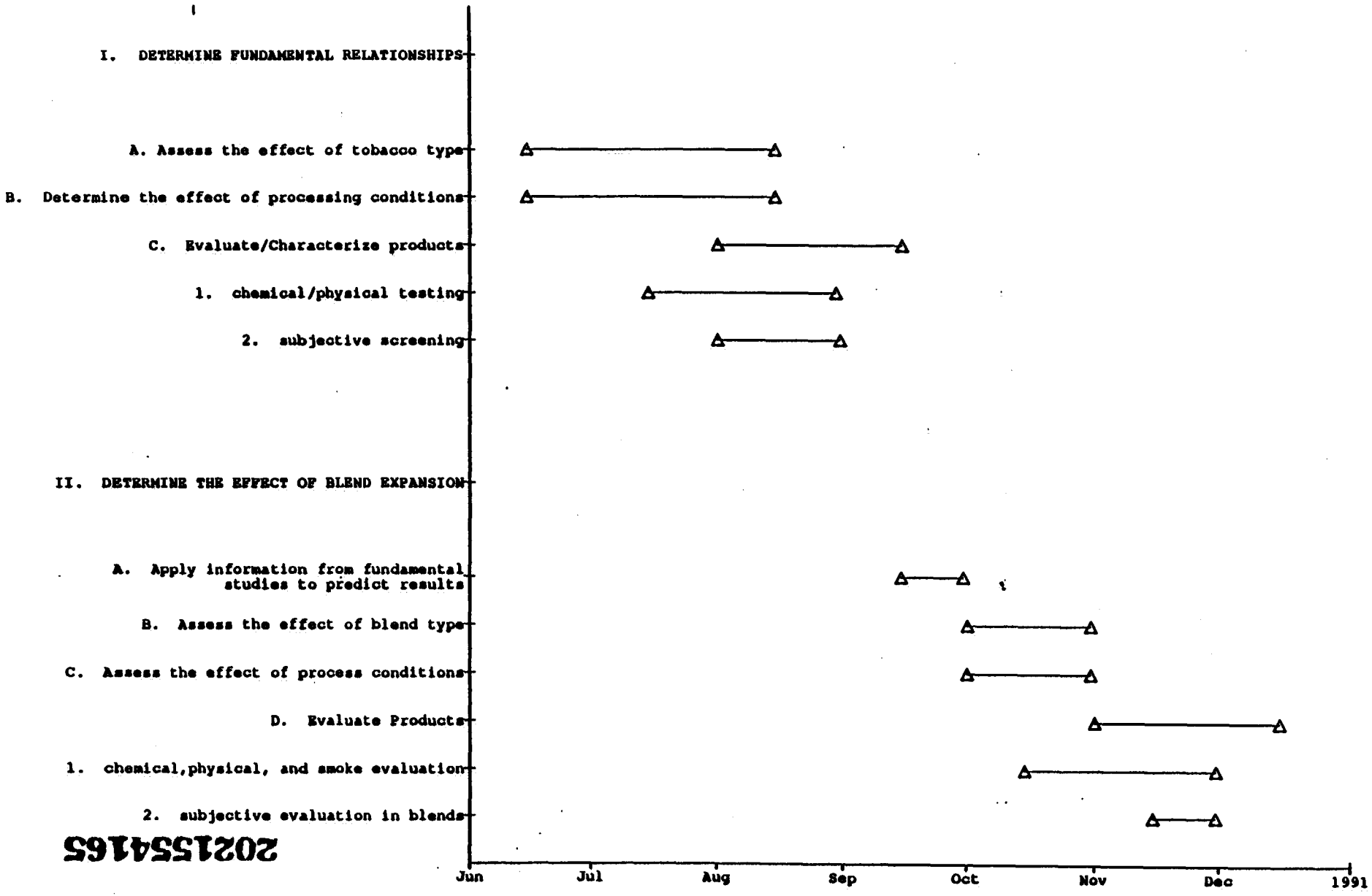
Gantt Chart of
Partial Expansion of Tobacco with Existing DIET Process Equipment



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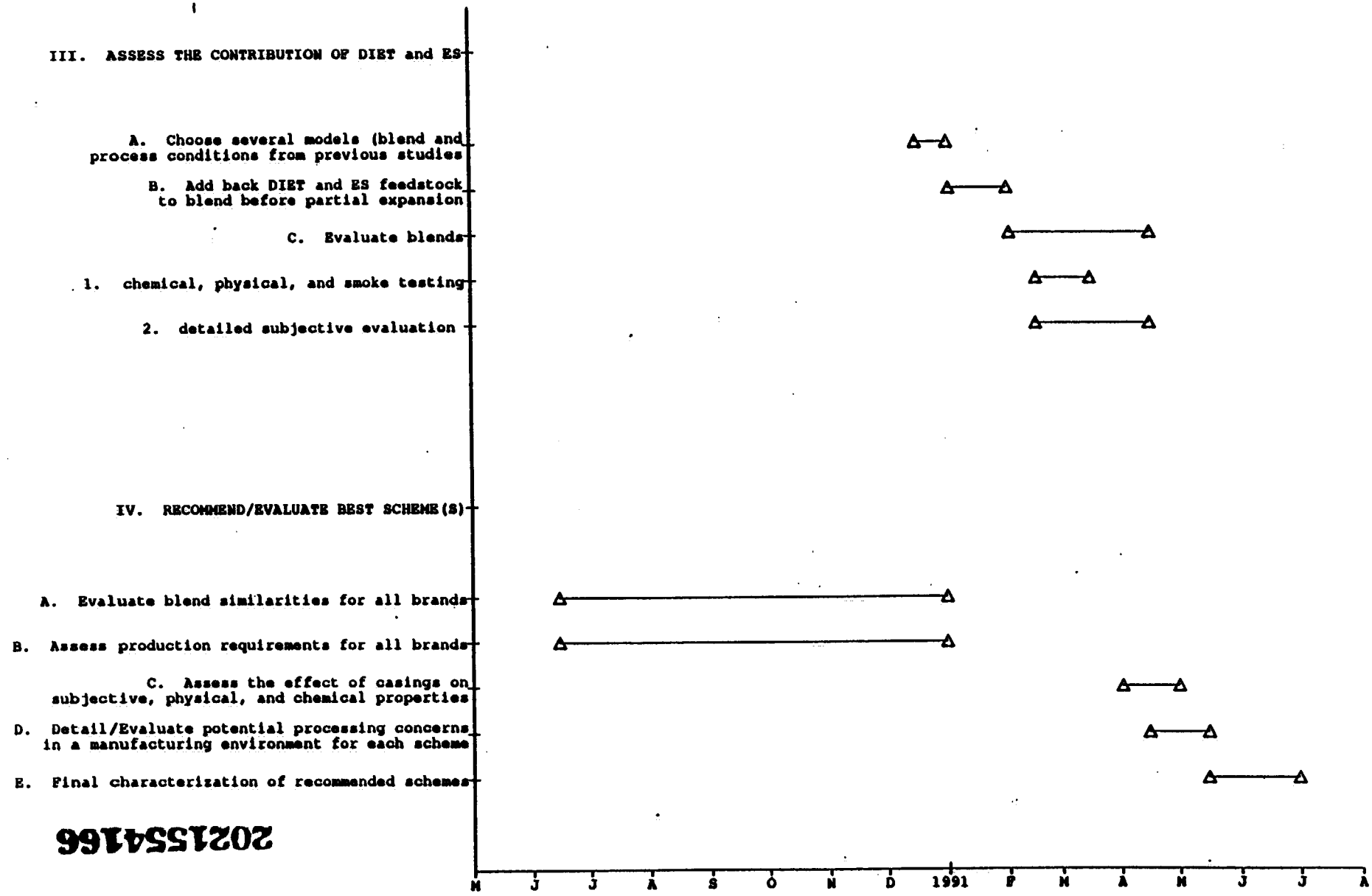
Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

Gantt Chart of
Partial Expansion of Tobacco with Existing DIET Process Equipment



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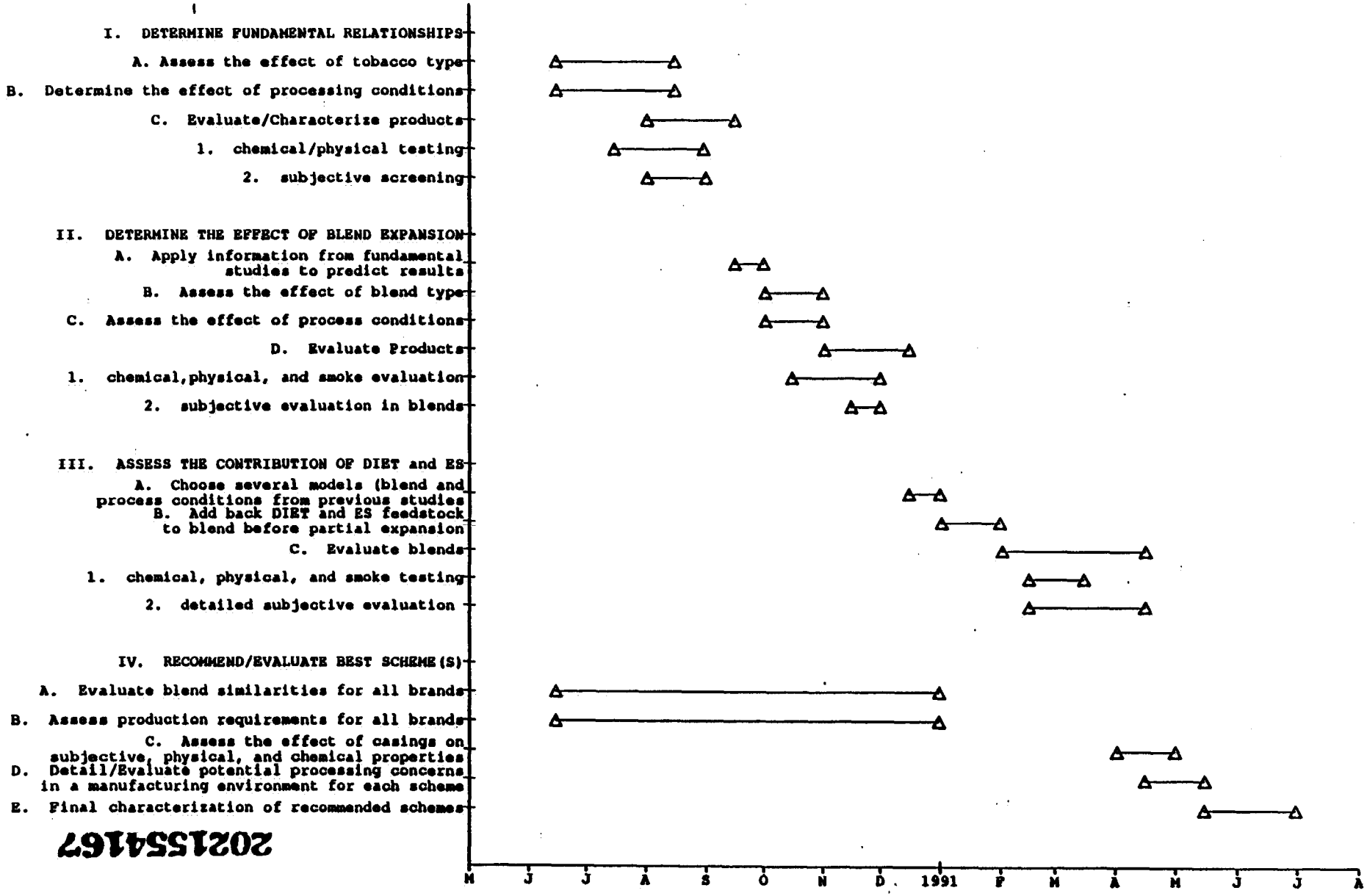
Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

Gantt Chart of
Partial Expansion of Tobacco with Existing DIET Process Equipment



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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

DRD DEP
6/21/90

Program Plans - Alternate Processes for Partial Expansion of Tobacco

Project Statement

Develop and evaluate processing alternatives to the DIET process to produce partially expanded tobacco for inclusion in cigarette blends, which will reduce cigarette density to 0.18 g/cc while maintaining physical and subjective characteristics.

Project Objectives

Define alternate expansion process(es) to be evaluated in a pilot plant development system to meet the criteria of the project statement.

1. Review and summarize previous work.

2. Identify potential processing schemes and test concepts with existing equipment, lab evaluations, and/or vendor tests.

3. Construct a pilot development facility.

For each process determine acceptable combinations of feedstock and processing conditions for all Philip Morris brands and evaluate their economic impact as outlined below.

4. Determine the relationship between processing conditions and subjective/physical properties for each tobacco type (bright, burley, oriental).

5. Compare the effect of blend expansion in various combinations with the expansion of individual blend components on subjective/physical properties.

6. Determine the contribution of DIET and ES components to subjective/physical properties both as standard expanded products and as included in partial expansion.

7. Analyze blend similarities and production requirements for all brands.

8. Propose one or more processing schemes for detailed physical, chemical, subjective, and economic evaluation.

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

Program Plans

I. Review and Summarize Previous Work

A. Review final reports — June 1990
   1. WET
   2. Hauni steam tunnel
   3. Hambro dryer
   4. Microwave expansion

B. Summarize results in memo — June 1990

II. Identify and Test Potential Processing Schemes

A. Conduct brainstorming session — July 1990

B. Confirm previous results in pilot plant — June-July 1990
   1. WET
   2. Hauni tunnel/Hambro dryer

C. Expand upon "old" concepts in pilot plant — June -July 1990
   1. Impregnation/Adt dryer
   2. Impregnation/Hauni tunnel/dry
   3. Superwet/Hauni tunnel/dry

D. Complete small scale trials of other concepts — July-August 1990
   1. cellulase treatment
   2. peroxide expansion
   3. carbonated water
   4. concepts from brainstorming session

E. Apply promising equipment/processes from group's work
   1. constant moisture heating — September 1990
   2. flash dryers
   3. gaseous impregnation
   4. high moisture impregnation/expansion

F. Set up process for evaluation of microwave expansion with assistance from Development Engineering — August-October 1990

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G. Evaluate trials — ongoing
   1. Equilibrated CV/OV
   2. SV
   3. Chemical Analysis
   4. Subjective screening

H. Choose the most promising scheme(s) for more refined testing — Oct.-December 1990

III. Construct pilot development facility

A. Define process flow scheme(s) — November 1990
   1. Need for flexibility
   2. Range of operating parameters

B. Specify requirements — December 1990
   1. Equipment
   2. Space
   3. Utilities
   4. Instrumentation
   5. Sampling ports

C. Review process scheme with PM Engineering — December 1990

D. Prepare 650 or Job Order and obtain approval — Dec. 1990-Jan. 1991

E. Prepare detailed design and layout with Development Engineering — January 1991

F. Order and receive equipment, instrumentation,etc. — Jan.-April 1991

G. Installation and checkout of equipment — May-June 1991

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Once the pilot devlopment facility is completed a detailed process development program will be undertaken as described below. Timescales for the project will be discussed separately.

IV. Determine Fundamental Relationships

A. Assess the effect of tobacco type
   1. DBC Bright
   2. DBC Burley
   3. Oriental
   4. Total Marlboro blend

B. Determine the effect of processing conditions
   1. Temperatures
   2. Steaming rates
   3. Tobacco feed rate
   4. Impregnation
   5. Residence time

C. Evaluate/Characterize products
   1. SV
   2. Equilibrated CV/OV
   3. Chemical Analysis
   4. Subjective screening

V. Determine the Effect of Blend Expansion

A. Apply information from fundamental studies to predict results

B. Assess the effect of blend type
   1. DBC bright and DBC burley
   2. DBC bright and Oriental
   3. Oriental and DBC burley
   4. DBC bright, burley and Oriental
   5. Total Marlboro blend

C. Assess the effect of process conditions
   1. As determined from fundamental studies

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D. Evaluate Products
   1. SV
   2. Equilibrated CV/OV
   3. Chemical analysis
   4. Subjective evaluation in blends
   5. Cigarette physical/smoke evaluation of selected blends

E. Compare results to individually expanded materials that are blended together

VI. Assess the Contribution of DIET and ES

A. Choose several models (blend and process conditions) from previous studies

B. Add back DIET bright feedstock and ES feedstock (CRS) to the blend before partial expansion

C. Evaluate blends
   1. Blend equilibrated CV/OV
   2. Chemical analysis
   3. Detailed subjective evaluation
   4. Detailed physical/smoke evaluation of cigarettes

D. Compare results to same blends but with standard DIET and ESB added

All testing during the first three phases will use tobacco cased with standard DETA casing. The addition of more traditional blend casings will be addressed only under the detailed final evaluation of one or more processing schemes.

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VII. Recommend and Evaluate the most promising scheme(s)

A. Evaluate blend similarities for all brands

B. Assess production requirements for all brands

C. Assess the effect of casings on subjective, physical, and chemical properties

D. Detail and evaluate potential processing concerns in a manufacturing environment for each scheme
   1. Blending
   2. Casings

E. Conduct complete physical, chemical, smoke, and subjective characterization with assistance from Product Development

F. Complete scale-up calculations and recommendations

Timescales

Outlined below is a detailed timescale for completion of the program after the completion of the pilot development process, broken down by each of the development phases previously discussed. The estimated completion dates for the various tasks assumes 2 days/week testing. In addition, it has been assumed that standard technician support for pulling/submitting samples and running sieves will be available from the D Pilot Plant Technicians. Gantt charts for the program schedule are attached.

IV. Determine Fundamental Relationships

• test design	April 1991
• testing	May-June 1991
• subjective screening	July 1991
• data evaluation	July-August 1991

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Timescales (cont'd)

V. Determine the Effect of Blend Expansion

•test design	July 1991
•testing	August 1991
•cigarette preparation/physical evaluation	September 1991
•subjective evaluation	September 1991
•data evaluation	October 1991

VI. Assess the Contribution of DIET and ES

•test design	October 1991
•testing	November 1991
•cigarette preparation	December 1991
•cig. physical/smoke evaluation	Dec. 1991-Feb. 1992
•detailed subjective evaluation	Dec. 1991-Feb. 1992
•data evaluation	Jan.-February 1992

VII. Recommend and Evaluate the most promising scheme(s)

•evaluation of blends/production reqmts.	ongoing
•assess effect of casings	February 1992
•detail/evaluate processing concerns	Feb.-March 1992
•final characterization of recommended schemes	March-April 1992
•equipment scale-up calculations/recommendations	May 1992
•final report and transfer of technology	June 1992

Resource Requirements

Semiworks Primary:	•Blend preparation of approximately 30 small scale blends •Blend preparation of approximately 20 large scale blends
Semiworks Make/Pack:	•Cigarette making of approximately 60 models
Materials Evaluation:	•Physical evaluation of the above blends and cigarettes •CV and OV analysis of pilot plant runs
Cigarette Testing:	•Smoke analysis of the above cigarettes
Development Engineering:	•Prototype and pilot plant design and construction

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Resource Requirements (cont'd)

Analytical:	• Chemical analysis on approximately 75 samples
Technician Support:	• Assistance in completing sieve and SV analysis and in sampling • Assistance in coordinating blends/cigarettes thru Semiworks
Flavor Development:	• Assistance in identifying and addressing subjective concerns
Leaf Blending Group:	• Assistance in subjective characterization
NET panel:	• Subjective screening

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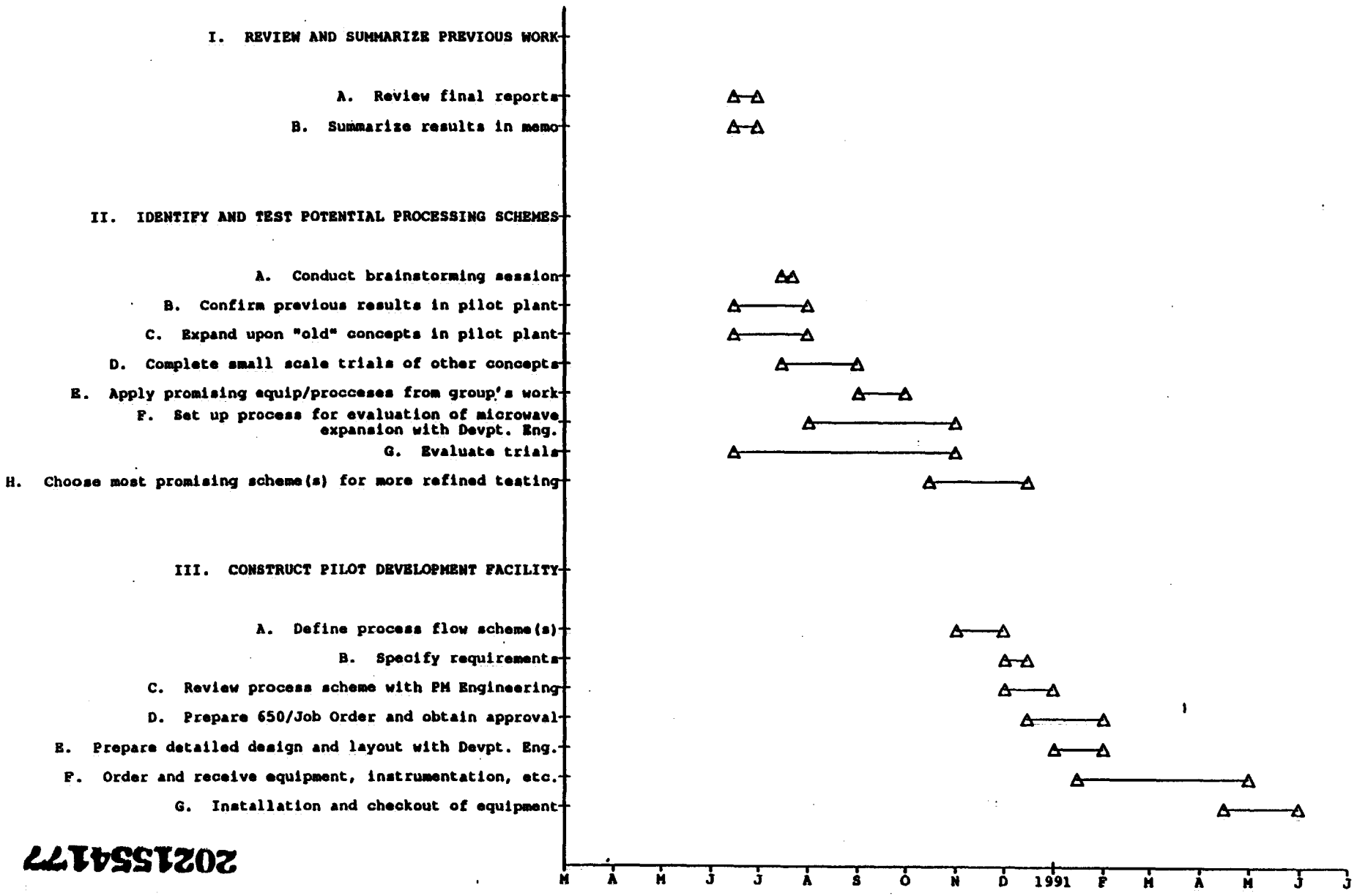
Gantt Chart of
Development Program for Alternate Partial Expansion Processes



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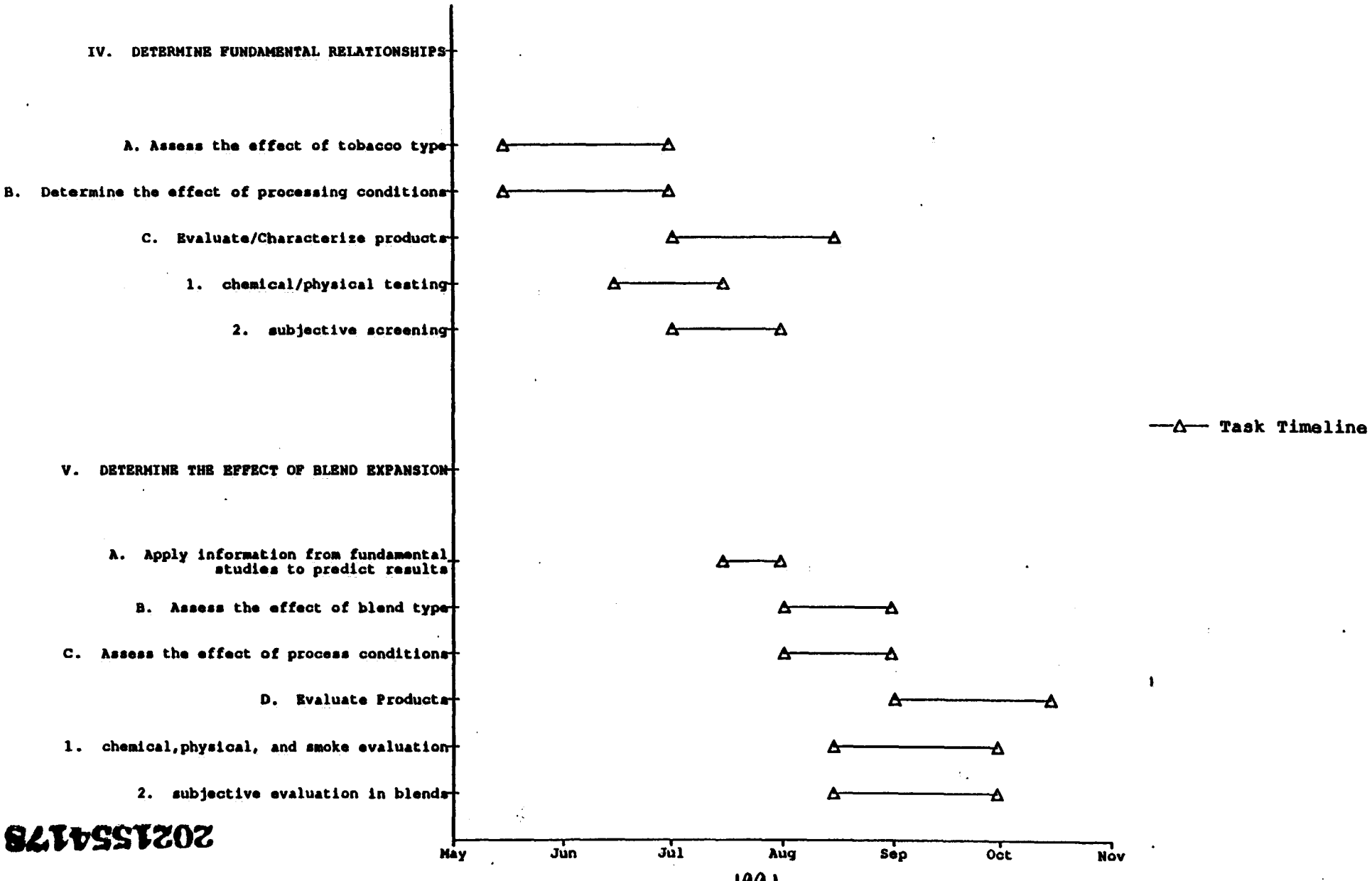
Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

Gantt Chart of
Partial Expansion of Tobacco with Existing DIET Process Equipment



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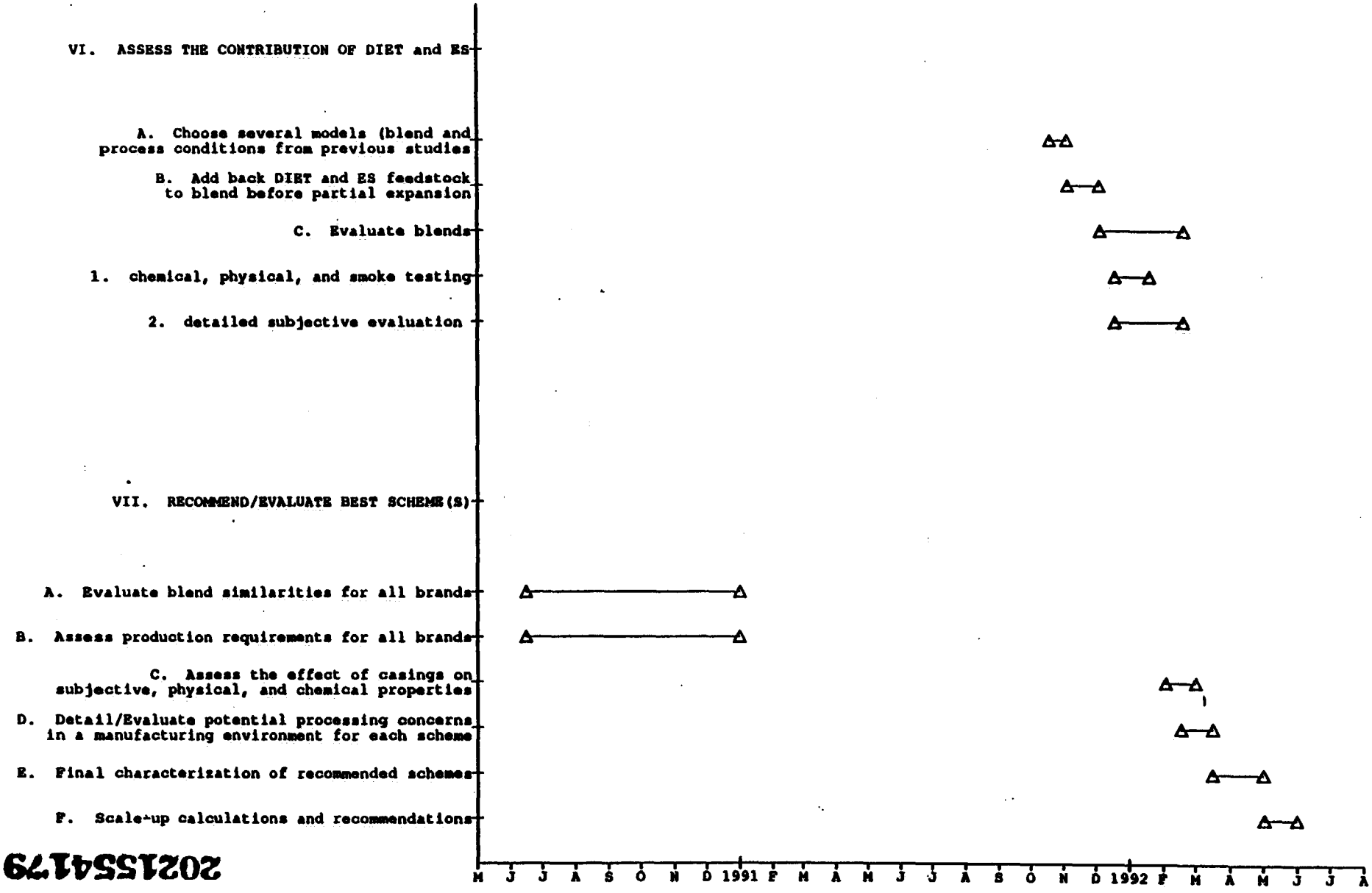
Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

Gantt Chart of
Development Program for Alternate Partial Expansion Processes



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Alternate Impregnation Process

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LONG-TERM
ALTERNATE IMPREGNATION PROCESS
FOR TOBACCO EXPANSION

PROJECT STATEMENT:

Develop an alternate impregnation process to:

- Improve subjectives of the expanded tobacco.
- Have equivalent cigarette filling power to the existing process.
- Be a continuous process.

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OBJECTIVES

-- Impregnation Process & Impregnator --

A. Determine conditions of tobacco impregnation with low pressure gaseous CO_2 .

B. Evaluate degree of subjective improvement for the cigarettes from gaseous CO_2 impregnation.

C. Investigate and evaluate possibility of inert gas impregnation.

D. Determine if filler casing process is necessary for gaseous impregnation.

E. Investigate expansion of other blend components using gaseous impregnation.

F. Develop, design, fabricate and install a continuous impregnation system.

-- Impregnation Mechanism Research --

G. Determine the physical and/or chemical forms the impregnant takes within the tobacco.

H. Quantify sorption properties of the substrate at equilibrium.

I. Quantify the sorption properties of the tobacco substrate under dynamic conditions.

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DETAILED OBJECTIVES

-- Impregnation Process and Impregnator --

A. Determine conditions of tobacco impregnation with low pressure gaseous CO_2 .

Complete test grid for:

1. Impregnation temperature vs gas pickup for 50, 150, 250, 350, 450, 800 psig.

2. Impregnation temperature vs gas pickup after 10(?) minutes for 50, 150, 250, 350, 450, 800 psig.

3. CV of expanded tobacco vs temperature for 'A-1'.

4. Optimum OV for impregnation.

   a. Select the optimum impregnation/expansion conditions from the above grid.

   b. Conduct tests for 14% OV and 21% OV tobacco from 'a'.

   c. If CV from 21% OV filler is much less than CV from 14% OV filler, obtain the optimum impregnation OV between 10 - 20%.

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B. Evaluate degree of subjective improvement for the cigarettes from gaseous CO_2 impregnation.

Design the process conditions and conduct correct subjective comparison of the following cigarettes:

- Liquid CO_2 impregnation
- 800 psig gaseous CO_2 impregnation
- Lowest pressure of gaseous CO_2 impregnation from 'A'

C. Investigate and evaluate possibility of inert gas impregnation.

1. Conduct impregnation/expansion test with N_2 , Ar and SF_6 .

2. If 'C-1' fails, conduct impregnation/expansion tests using minimum CO_2 with:

   - CO_2 + N_2
   - CO_2 + Ar
   - CO_2 + SF_6

D. Determine if filler casing process is necessary for gaseous impregnation.

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1. Conduct sieve tests for 21% OV cased vs uncased filler to evaluate tobacco degradation.

2. Conduct expansion rate tests for cased and uncased filler with information from 'A'.

E. Investigate expansion of other blend components using using gaseous impregnation.

Conduct expansion rate tests from 'A', 'C' and 'D' for:

- Turkish
- Burley w/o Top Casing
- Burley w Top Casing

F. Develop, design, fabricate and install a continuous impregnation system.

1. Install a coupled bench top impregnation system consisting of (2) high-pressure ball valves with (1) pipe.

2. Evaluate the following with the above bench top impregnator:

   a. How much we can capitalize unstable impregnation when tobacco is impregnated at low pressure from 'A' by coupling impregnation and expansion.

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b. Determine the optimum cooling method(s).

- Impregnant as a cooling medium.
- Precool tobacco and its method.
- External jacket cooling and its design parameters.
- Liquid impregnant injection and its method.

c. Required impregnation cycle time.

- Pressurization.
- Cooling.
- Depressurization.

3. Investigate manufacturing feasibility of the high-pressure rotary valve. If the high-pressure rotary valves are applicable for a continuous impregnation, install a system consisting of (3) pipes connected with (4) high-pressure rotary valves to evaluate the following:

a. Tobacco transfer between rotary valves and pipes.

b. Cycle time to evaluate if a screw conveyor is necessary.

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4. Perform tests with screw conveyor to evaluate the following by using Dr. Zenz' Plexiglas screw conveyor:

   a. Tobacco degradation regarding:

      - Tobacco OV (12%, 16%, 21%).
      - Screw diameter.
      - Tobacco density (30 lb/ft^3 , 50 lb/ft^3)
      - Screw pitch.
      - RPM.

   b. Method of tobacco feed and discharge to/from screw conveyor for uniform and metered tobacco flow.

5. If high-pressure screw conveyor is required and justifiable from the above tests, install a continuous high-pressure screw (HPS) conveyor system consisting of:

   a. (4) high-pressure rotary valves.
   b. (2) cylinders.
   c. (1) high-pressure screw conveyor.

6. Continue investigating feasibility of a continuous screw impregnator (CSI) design and fabrication or development of other continuous impregnation systems.

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

-- Impregnation Mechanism Research --

G. Determine the physical and/or chemical forms the impregnant takes within the tobacco.

1. Use molecular spectroscopy to directly elucidate structural conformation of the impregnant.

   a. Background and literature search.

   b. Develop experimental plan and purchase equipment.

   c. Perform studies and evaluate data.

2. Use high pressure pH measurements and/or wet chemical methods to determine carbon dioxide absorbtivity in tobacco through solution chemistry.

   a. Complete evaluation of high-pressure pH probe.

   b. Measure carbon dioxide uptake in tobacco extracts.

   c. Extrapolate extract data to tobacco and determine applicability to expansion.

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d. Determine carbon dioxide dissolution kinetics.

3. Use consultant to further understand clathrate formation and pursue research course based on his recommendation or contract for lab services.

H. Quantify sorption properties of the substrate at equilibrium.

1. Use aqueous extracts of tobacco to study the absorbtion of impregnants as related to the NET or DIET processes.

   a. Complete measuring the solubility of gas in these solutions.

   b. Measure the decomposition temperature of the hydrates that may form in these solutions and estimate the amount of gas absorbed by the clathrates.

2. Use the isochoric cooling technique developed by Sloan *et al.* to measure the amount of gas uptake into tobacco.

   a. Complete quantifying the amount of CO_2 uptake by bright tobacco as a function of pressure, OV, and casing relative to a reference temperature.

   b. Determine the absolute amount of CO_2 uptake at the above reference temperature and relate to previous measurements.

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

I. Quantify the sorption properties of the tobacco substrate under dynamic conditions.

1. Use stability of the impregnant in the tobacco substrate over time as an indicator for dynamic changes.

   a. Determine the amount of absorbed impregnant remaining in the substrate after venting, over time, as a function of impregnation temperature, pressure, and OV using CO_2 or nitrogen.

   b. Determine the applicability of using the above most promising impregnation conditions for expansion through pilot plant tests.

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SCHEDULE - NEW IMPREGNATION

ITEMS	COMPLETION DATE
IDENTIFY IMPREGNATION PROCESS	
Conduct subjective tests for liquid and gaseous CO2	Jul., 1990
Install bench top impregnator - Coupled/Batch	Aug., 1990
Determine necessity of casing process	Aug., 1990
Complete test grid for Pressure, Temp, OV and Timme	Sep., 1990
Perform inert gas impregnation	Nov., 1990
Obtain a potential weight reduction from blend expansion	Jan., 1991
IDENTIFY IMPREGNATION MECHANISM	
Quantify sorption properties of substrate @equilibrium	Sep., 1990
Quantify sorption properties of substrate @dynamic cond.	Sep., 1990
Identify physical/chemical formation of impregnant	Jan., 1991
INSTALL/TEST THE NEW IMPREGNATOR	
Test screw conveyor @ Dr. Zenz' facility	Aug., 1990
Identify high pressure rotary valve manufacturer	Aug., 1990
Install high pressure rotary valve system	Dec., 1991
Complete necessary tests with hi-press rotary valve sys.	Feb., 1991
Develop other conceptual continuous impregnator	Dec., 1990
Select manufacturer of the new impregnator	Feb., 1991
SELECT THE NEW IMPREGNATION SYSTEM	MAR., 1991

Hi pressure screw conveyor with ball valves
Hi pressure rotary valve with cylinders
Hi pressure screw conveyor with hi pressure rotary valves
Other new continuous impregnation system

Install the new impregnation system	Sep., 1991
Complete necessary tests with the new system	May, 1992
Scale-up the new impregnation system	Sep., 1992

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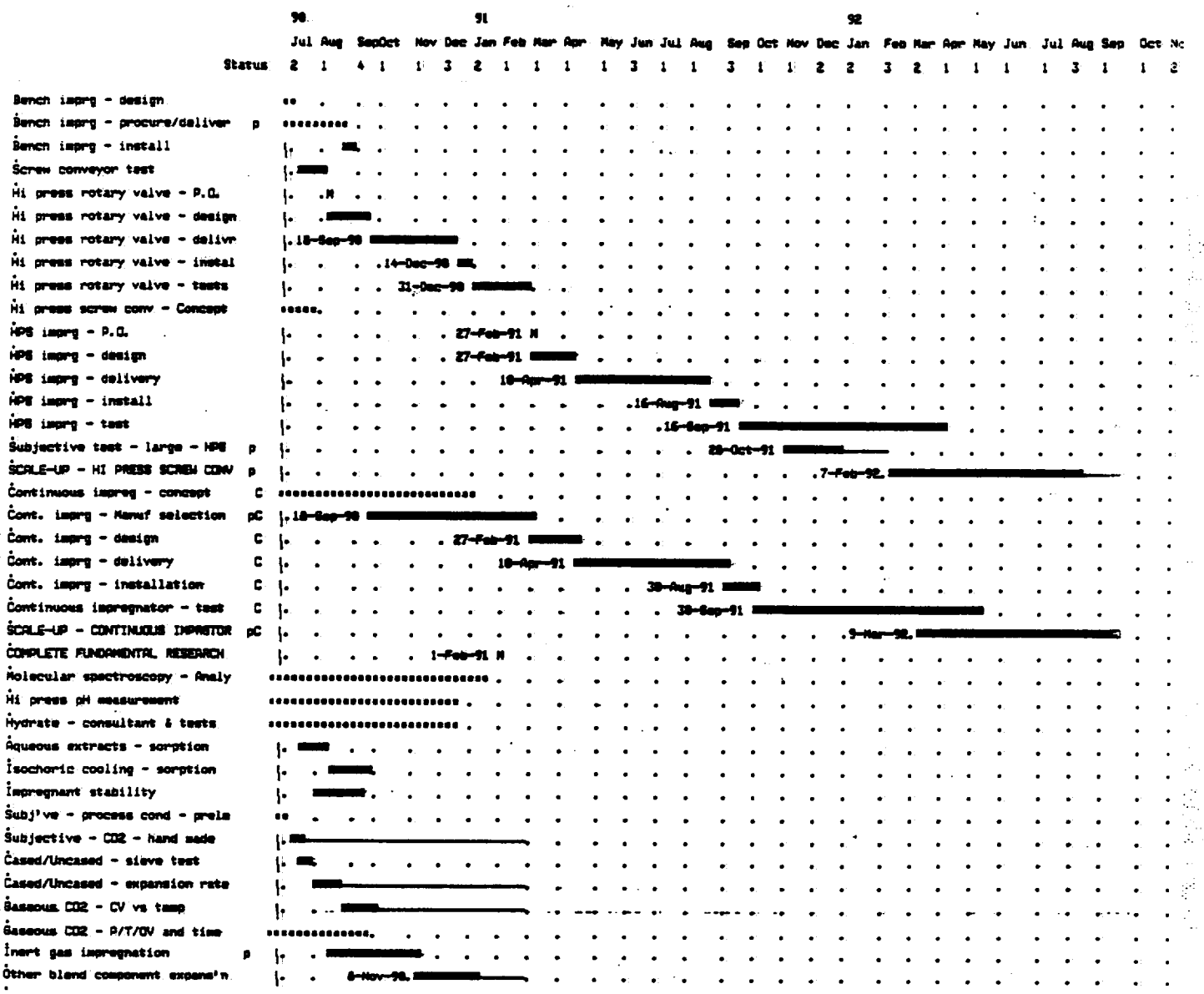

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Alternate Puff/Dry/Set Techniques

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2021554193

LONG TERM
ALTERNATE PUFF/DRY/SET TECHNIQUES

PROJECT STATEMENT:

Define alternate means of puffing, drying, setting and reordering impregnated tobacco which will improve product subjectives and physical characteristics relative to the present DIET process.

SPECIFIC OBJECTIVES:

I. Determine if high temperature, short time (HTST) puffing/drying/setting improves subjectives or enhances physical characteristics relative to present process.

II. Determine if forced cooling after thermal processing improves subjectives.

III. Determine the effect of elevated moisture content expansion and setting on physical characteristics and subjectives.

IV. Evaluate a vertical rise only tower for its impact on physical characteristics and their uniformity.

V. Evaluate a condensation/conduction processor in place of condensation/convection system of present tower.

VI. Evaluate post expansion heat treatment and, if effective, determine modifications to process to allow use.

VII. Determine if tobacco structure can be set with less or no thermal treatment.

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

DETAILED OBJECTIVES:

I. Determine if HTST puffing/drying/setting improves subjectives or enhances physical characteristics.

A. Test 8" tower at maximum temperature using plug flow baffle.

1. Vary gas flows to vary residence time.
2. Assess temperature effect on physical characteristics.
3. Assess subjectives if appropriate equilibrium OV levels attained.

B. Vendor test towers or other thermal contactors capable of operating at temperatures above present 8" maximum.

1. Assess tobacco handling capability.
2. Estimate heat transfer results.

C. Modify 3" tower, or design and build a bench top unit, for expanding impregnated tobacco at HTST conditions.

1. Bench top (or 3" modifications) design.
2. Construct bench top unit.
3. Assess physical characteristics.
4. Subjective screening.

D. Mathematically model the heat and mass transfer expected at HTST conditions.

E. Build HTST capability into vertical tower if possible, and if promising results obtained (Section IV.C., this plan).

F. Based on the above, select a pilot scale HTST unit for purchase or rental, and full evaluation (assumes not built into vertical tower).

1. Vendor selection and follow up test if required.
2. Design and order system.
3. System delivery.
4. Install and start up system.
5. Pilot testing.

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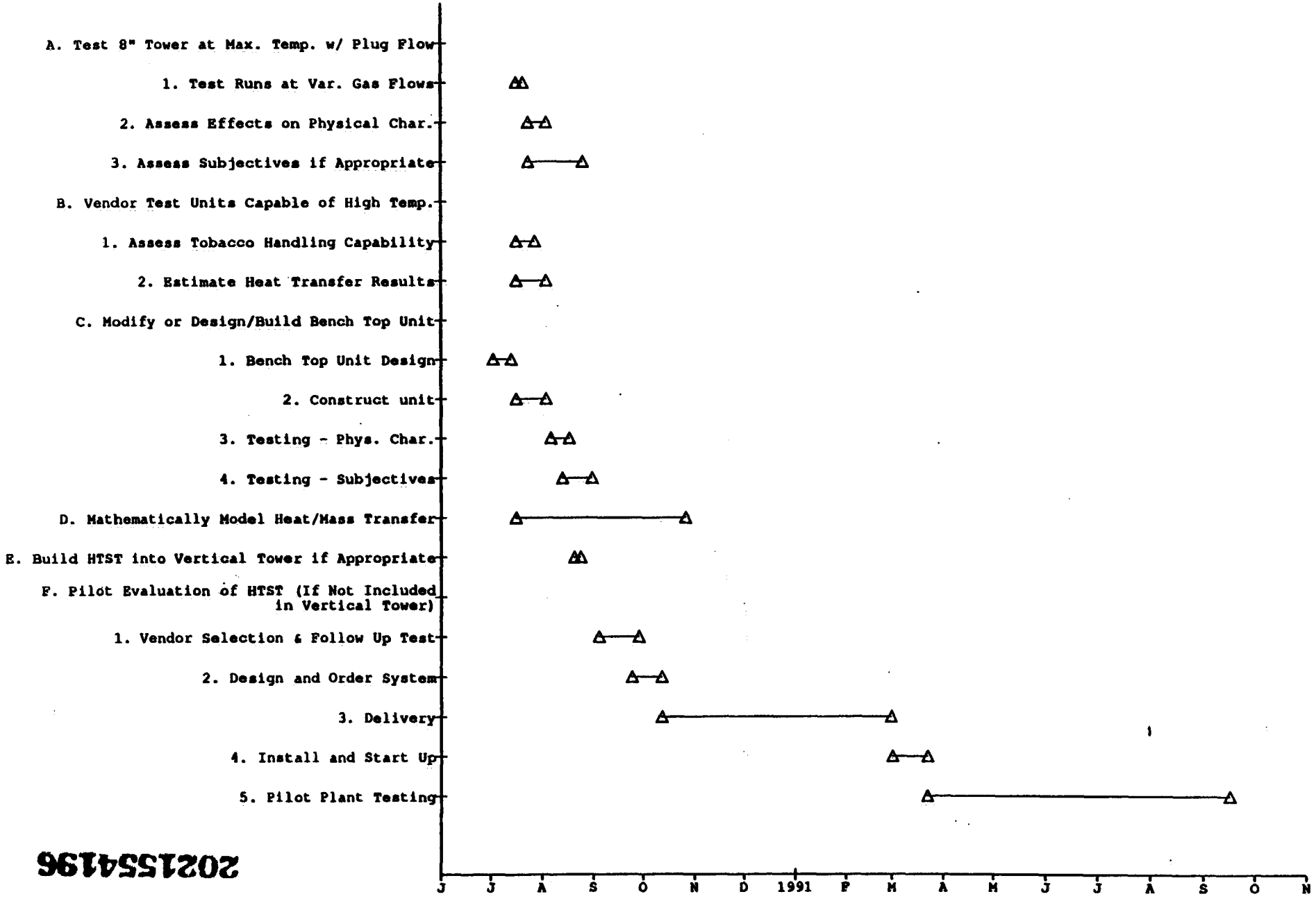
High Temperature, Short Time Expansion (HTST)



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II. Determine if forced cooling after thermal processing improves subjectives.

A. Develop a bench top cooling procedure for 5 lb samples of E.T.

B. Subjectively compare lab reordered vs. standard pilot reordered vs a rapidly cooled product.

1. Execute test runs.
2. Sample analysis (including subjectives).

C. Assess impact on physical characteristics.

D. Pending results of above, HTST, and elevated moisture expansion studies, include rapid cooling as a process option.

E. Mathematically model the cooling step if results are promising.

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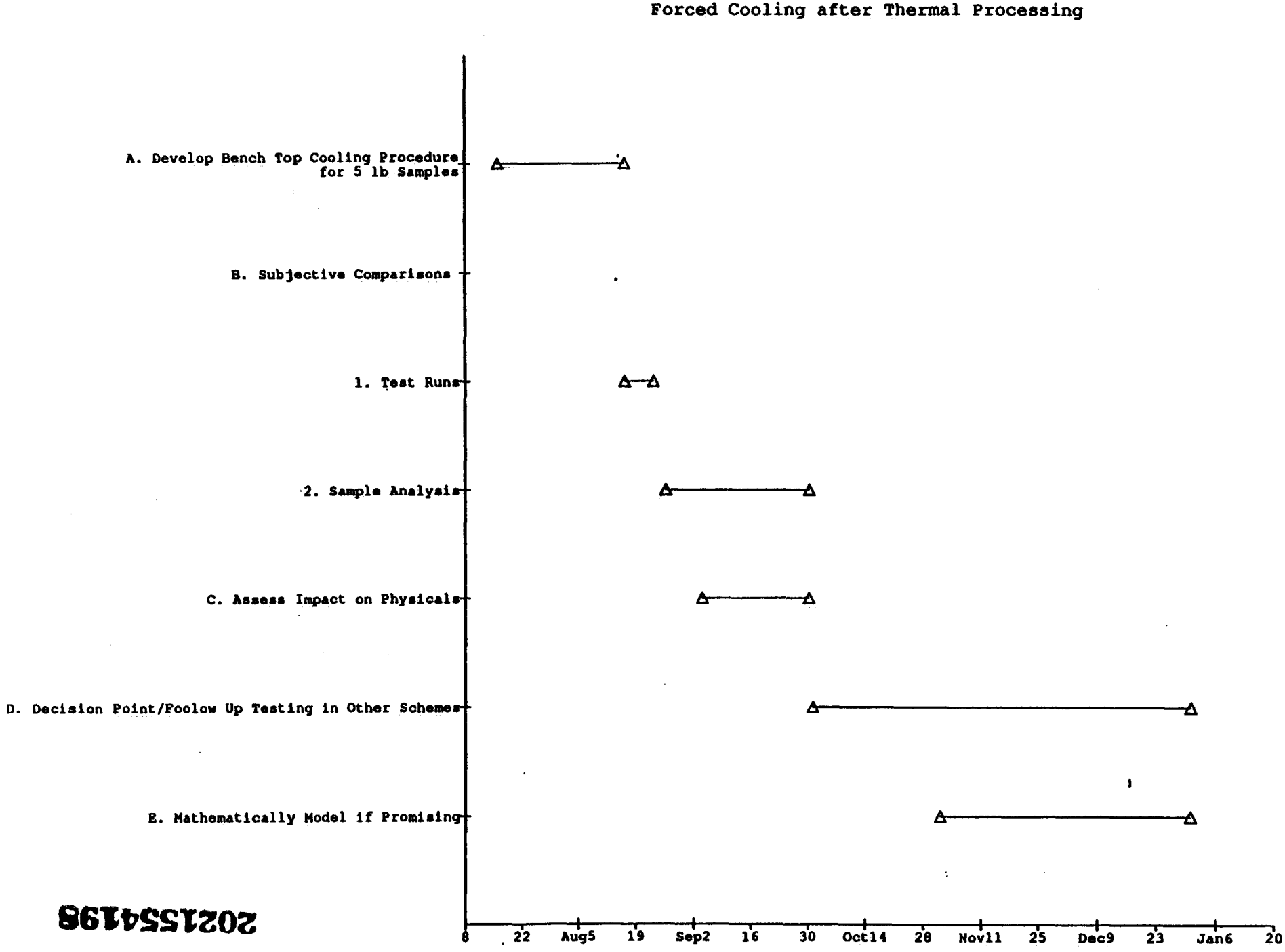

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III. Determine the effect of elevated moisture content expansion and setting on physical characteristics and subjectives.

A. Laboratory determination of the physical changes to tobacco during puffing.

1. Dimensional, stiffness, and acoustic emission at various OV's during puffing.
2. Determine expansion limits for tobacco as a function of OV.

B. Test high moisture content impregnated feed on 3" system.

1. Develop impregnation scheme.
2. Test using 3" system.

C. Construct and evaluate a bench top thermal contactor which minimizes moisture transfer.

1. Bench top unit design (may be same unit as in I.C.).
2. Construct bench top unit.
3. Test as expansion/dry/set, evaluate physical characteristics.
4. Test as set only using high moisture
5. Subjective screening of promising results.

D. Build HTST capability into vertical tower if possible, and if promising results obtained (Section IV.C., this plan).

E. Pending results of III.B.2 above, test high moisture impregnated feed on the 8" system.

F. Based on the above, select a pilot scale high moisture expansion unit for purchase or rental, and full evaluation (assumes not built into vertical tower).

1. Vendor selection and follow up test if required.
2. Design and order system.
3. System delivery.
4. Install and start up system.
5. Pilot testing.

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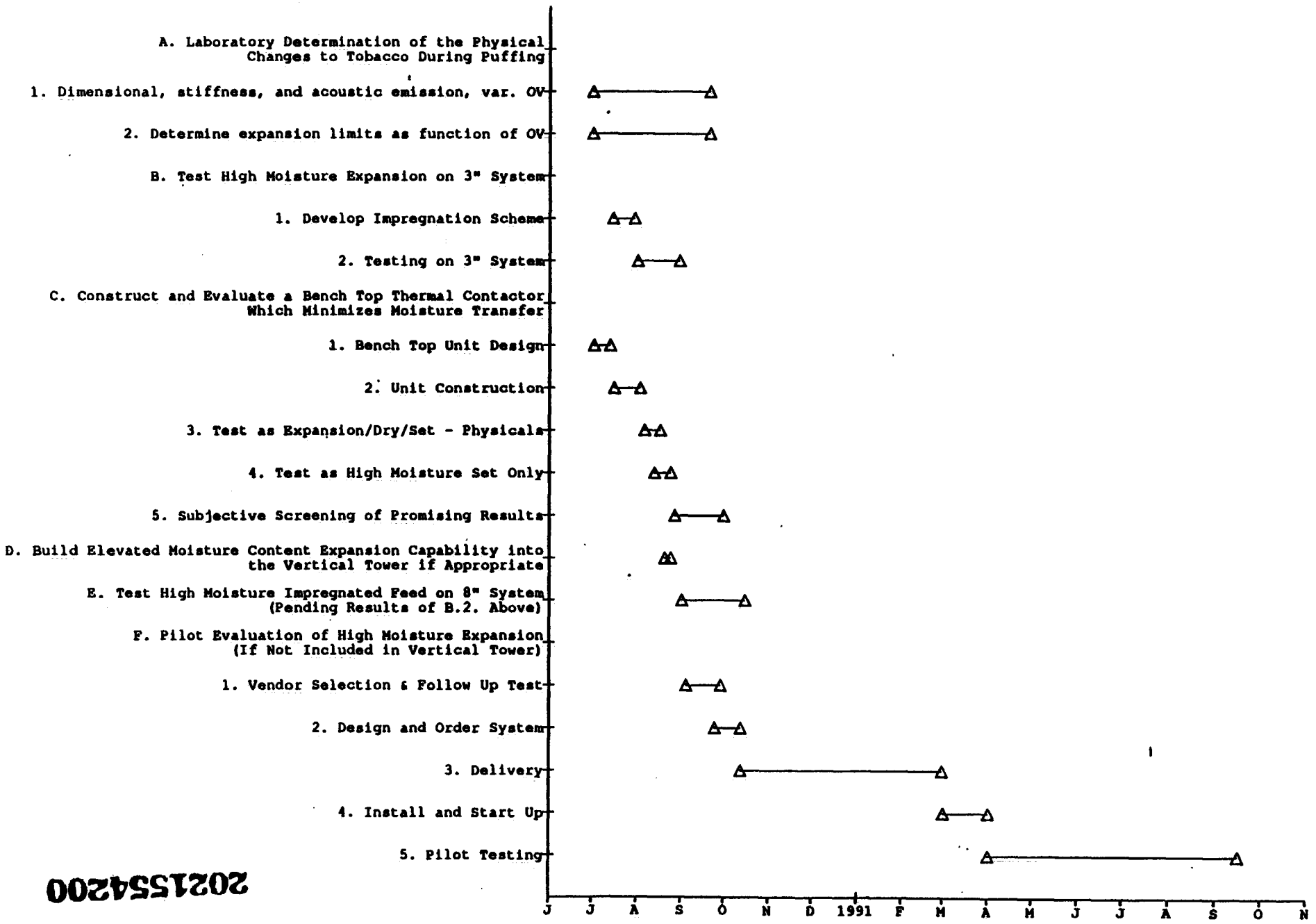
Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

High Moisture Content Expansion



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IV. Evaluate a vertical rise only tower for its impact on physical characteristics and their uniformity.

A. Vendor test vertical tower with single elbow using unimpregnated filler (CE Raymond).

1. Evaluate tobacco handling capability of vertical feeders.
2. Assess heat transfer and tobacco survivability.

B. Mathematically model flow, heat and mass transfer in a vertical rise tower.

C. Coordinate with short term program.

D. Pilot plant evaluation of vertical tower, if warranted by results above.

1. Vendor selection and follow up test if required.
2. Design and order system.
3. System delivery.
4. Install and start up system.
5. Pilot testing.

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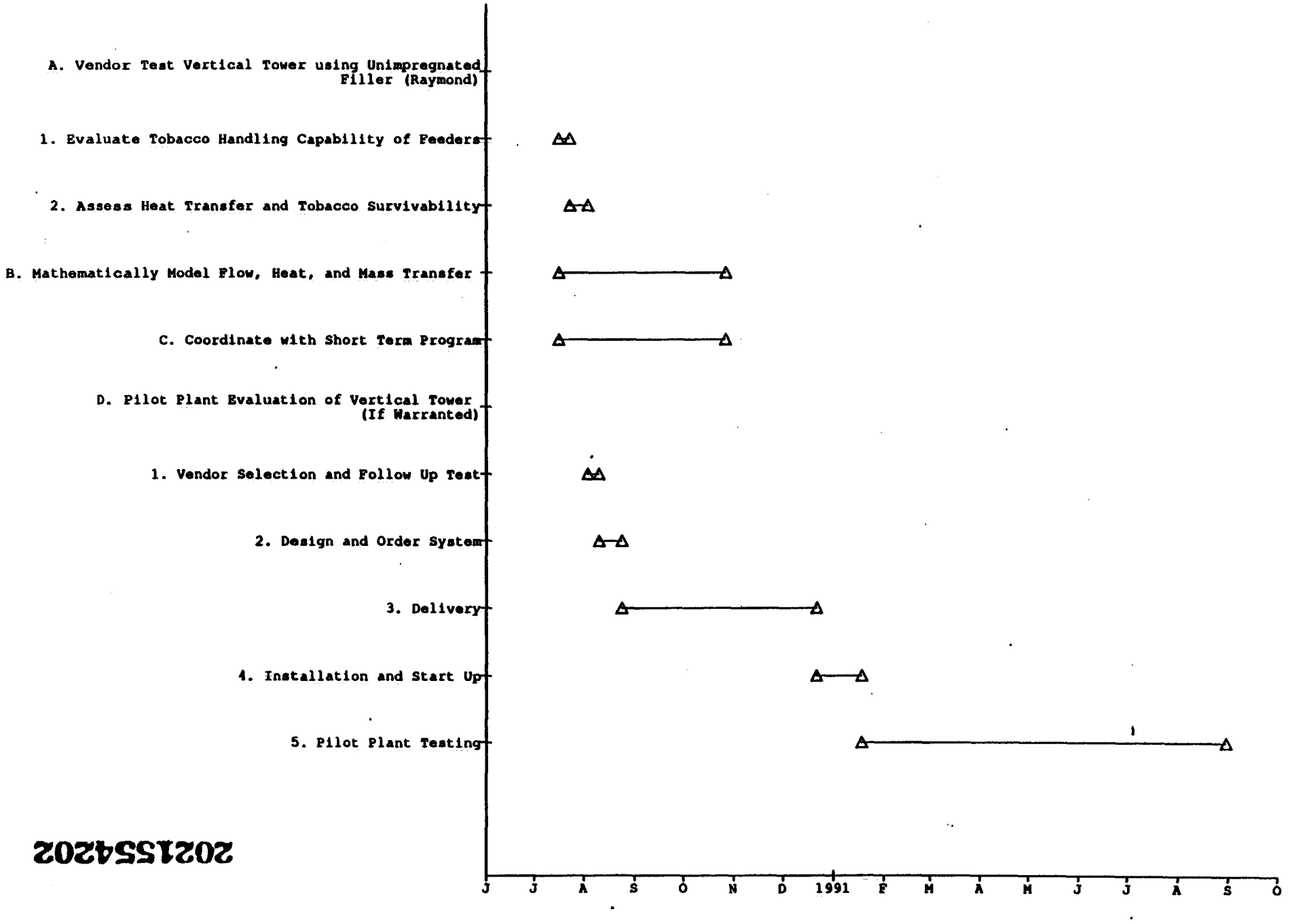
Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

Vertical Tower



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V. Evaluate a condensation/conduction processor in place of condensation/convection system of present tower.

A. Vendor test condensation/conduction processor using unimpregnated filler (Bepex).

1. Evaluate tobacco breakage.
2. Assess heat transfer with combinations of transfer modes and residence times.

B. Pilot test with impregnated filler if results of above are promising.

1. Determine test design, rental terms.
2. Lead time for rental delivery.
3. Install and start up rental unit.
4. Execute tests as expander and heat treatment unit.
5. Physical and subjective evaluations.

C. Decision point for follow up (go/no go).

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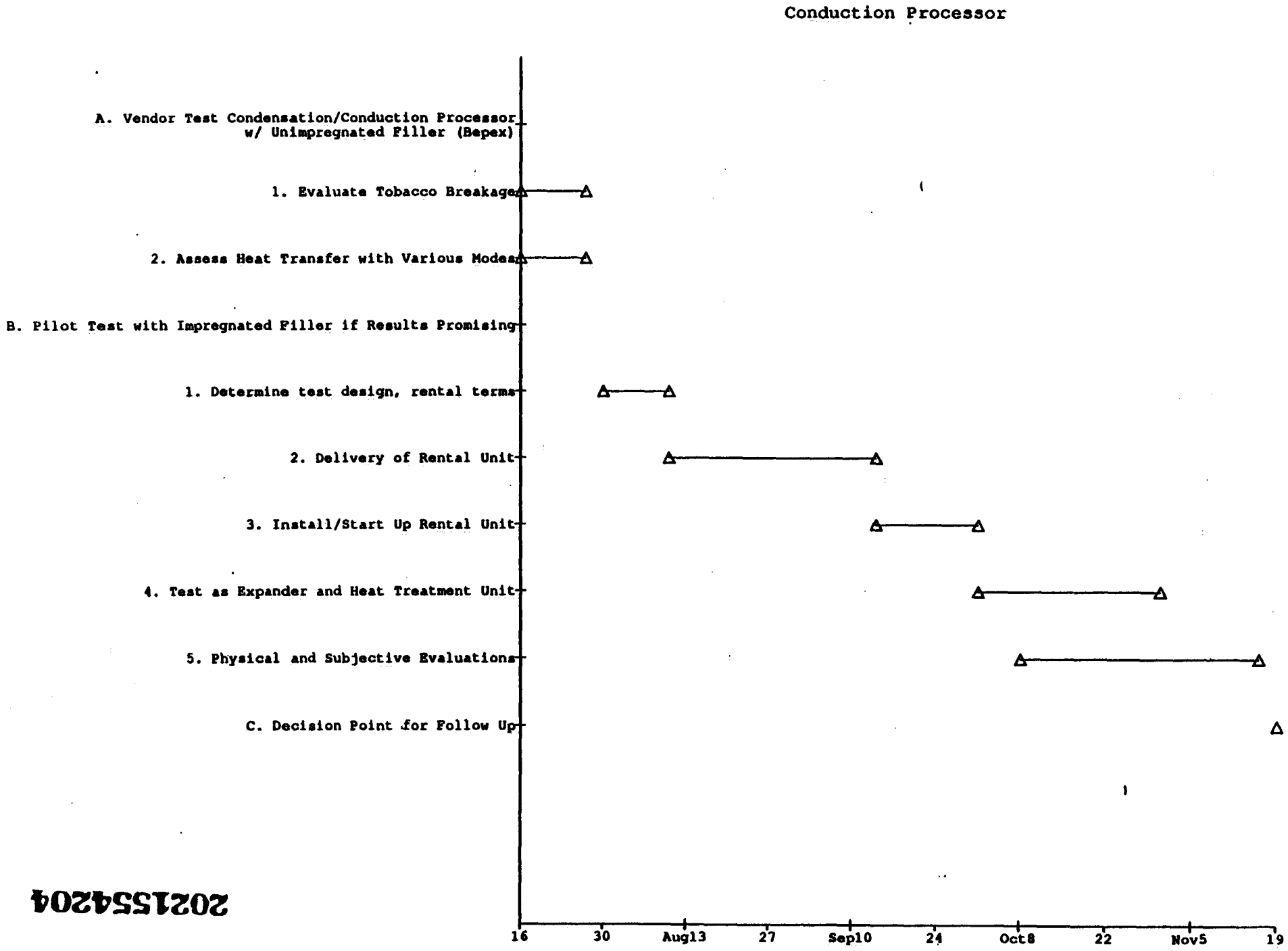

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VI. Evaluate post expansion heat treatment and, if effective, determine modifications to process to allow use.

A. Literature review on post expansion heat treatment (PEHT).

B. Pending review of above, build or get from warehouse a small scale PEHT unit.
   1. Design or retrieve a unit for PEHT.
   2. Install PEHT unit.

C. Evaluate the impact of PEHT on physicals and subjectives.

   1. Assess impact of various temperature/time regimes.
   2. Evaluate at different tobacco OVs.

D. Determine scale up considerations for PEHT.

E. Decision point for further pursuit of PEHT concept.

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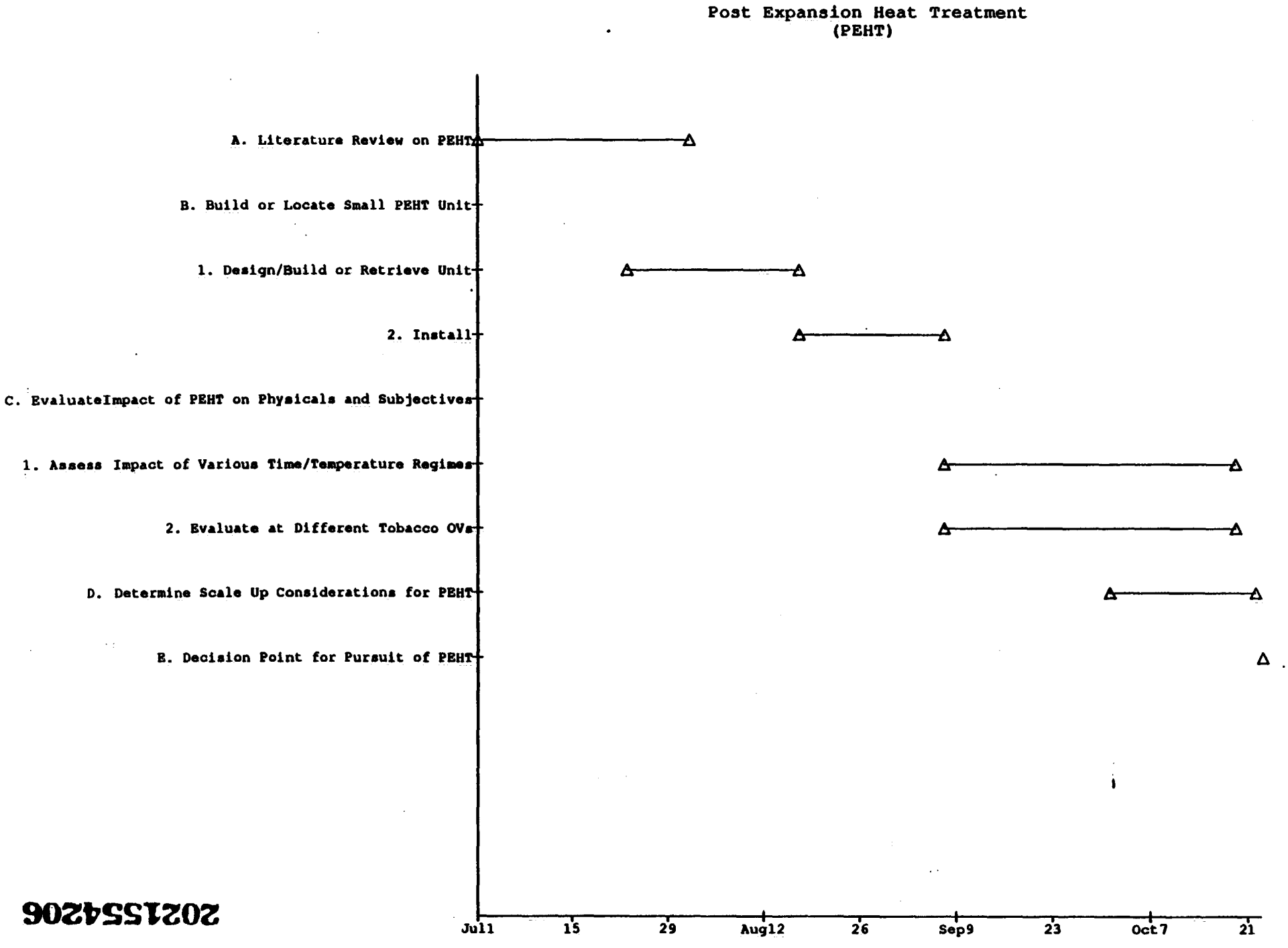

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VII. Determine if tobacco structure can be set with less or no thermal treatment.

A. Determine the physical and chemical changes associated with tobacco stiffening in the present process.

B. Determine the rate and extent of collapse in the present process.

1. Estimate rate of collapse for table top expansion using Spin Physics video camera.
2. Determine the extent of collapse as measured by SV and CV, as a function of reordering rate, final OV, and tobacco equilibrium OV.
3. Estimate the rate of collapse for both table top expanded and tower expanded tobacco using FTMA. Estimate stiffness changes with collapse.

C. Develop a mechanical model for expansion and collapse.

1. Spring/dashpot qualitative.
2. Quantitative.

D. Determine whether structure can be set (collapse can be minimized) by chemical means, in the lab and using the 3" tower.

1. Catalysis of present stiffening reactions.
2. Alternate crosslinking reactions.

E. Pending the results of above, execute pilot process development.

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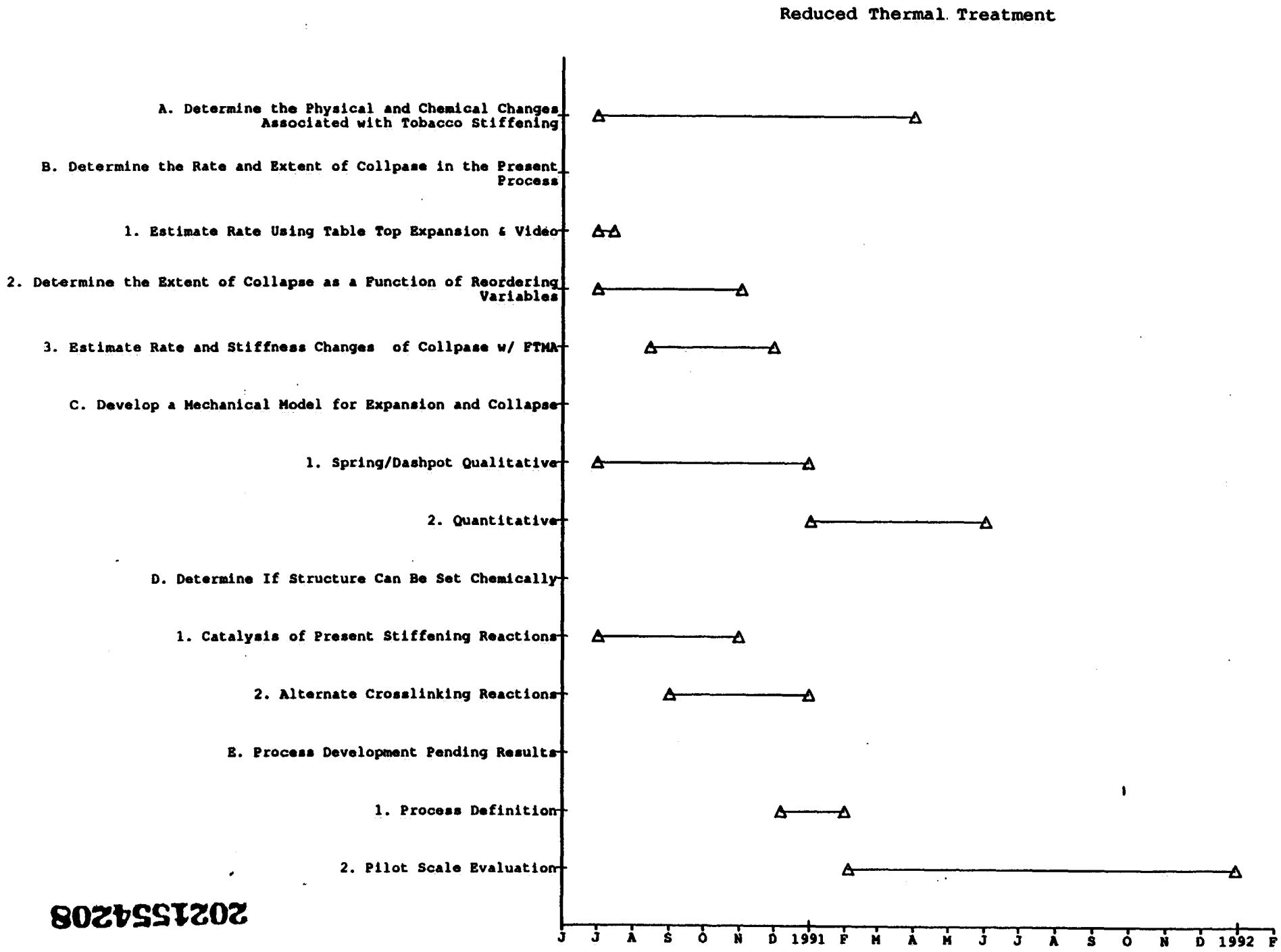
Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

Reduced Thermal Treatment



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Physical Research Support Programs

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

EXPANSION MECHANISM STUDIES: POSTEXPANSION COLLAPSE

Project 1708 has undertaken a research program to characterize the mechanism of tobacco expansion with the primary emphasis on postexpansion collapse. We are working to identify tobacco characteristics and process parameters which affect the extent or rate of collapse. These include impregnation and reordering as well as the expansion step. The ultimate objective is to use the information developed to formulate and then test strategies for minimizing postexpansion collapse.

The plans, outlined below, focus primarily on bright tobacco with carbon dioxide as the impregnant. The experiments will be expanded to include other tobacco types and expansion agents as appropriate.

Our intent is to give items III, V, and VI the highest priority as completion of these is expected to lead to a basic understanding of the expansion and collapse processes. Item VII will be pursued on a high priority basis as test compounds become available.

I. Determine the physical/chemical changes associated with tobacco impregnation.

Tobacco will be impregnated and then degassed. The following parameters will then be determined relative to the unimpregnated control: CV, SV, equilibrium OV and stress/strain characteristics as measured by the dynastat. Changes in chemical composition will also be monitored. These include pH, waxes, alkaloids, ammonia, and reducing sugars.

Completion date: September, 1990

II. Determine the physical changes to tobacco during puffing.

The dimensional changes during the puffing process will be monitored, at the laboratory level, with the spin physics camera. Dynamic stiffness changes during the puffing will be followed with FTMA. Accoustic emission will be used to assess whether any damage occurs to the tobacco during the expansion. We plan to carry out these experiments as a function of OV.

Completion date: October, 1990

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III. Determine the expansion limit for tobacco

The stretchability limit of tobacco will be determined using the "zero span" technique in conjunction with the dynastat. The measurements will be carried out as a function of strain rate, OV, and temperature. These experiments should yield not only the - stretchability limit of tobacco but also shed light on the magnitude and nature of the forces resisting expansion. As part of this program stress relaxation and recovery experiments will also be carried out. These will yield a measure of the restoring forces leading to postexpansion collapse.

Completion date: December 1990

IV. Determine the physical changes associated with tobacco stiffening.

Changes in the CV, SV, equilibrium OV, and stress strain behavior of thermally stiffened tobacco will be determined relative to untreated controls.

Completion date: March, 1991

V. Determine the extent of tobacco collapse.

The level of postexpansion collapse as measured by SV and CV will be determined as a function of reordering rate, final OV, and tobacco equilibrium OV.

Completion date: November, 1990

VI. Determine the rate of collapse.

A variety of techniques will be used to determine the rate of postexpansion collapse and the factors which influence it.

1. The rate of collapse following tabletop expansion will be monitored using the spin physics camera. This will give information with regard to the dimensional changes involved with collapse as well as giving an estimate of its rate.

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2. The rate of collapse for both tower exit and table top expanded tobacco will be monitored with the FTMA. This will yield an estimate of the rate as well as a measure of the dynamic stiffness changes associated with collapse.

3. The rate of collapse for tabletop expanded tobacco will be determined directly by freezing samples as a function of time in liquid nitrogen, lyophilizing, and determining the SV. This is the only direct method of tracking SV changes.

Completion date: November, 1990

VII. Determine whether collapse can be minimized by chemical means.

The use of innocuous crosslinking agents as a means of stiffening tobacco will be pursued in collaboration with Chemical Research.

VIII. Develop a mechanical model for expansion/collapse.

A spring/dashpot model will be developed for the expansion and collapse processes. The development of the model is dependent on data gathered in several of the items listed above. We expect to have a qualitative picture in hand within six months and, if feasible, a quantitative description in a year.

Support required:

We will continue to need pilot plant support for impregnation and expansion as well as the use of the Spin Physics camera as appropriate. For item VI we will need to have a lyophilizer, obtained from D. Teng, hooked up and made operational. Analytical support will be required for item I and for obtaining electron micrographs of expanded and collapsed tobacco. The micrographs will be needed for item V.

2021554212

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

I. Objective: Determine the physical and/or chemical forms the impregnant takes within the tobacco.

A. Strategy: Use molecular spectroscopy to directly elucidate structural conformation of the impregnant. NMR, IR

1. Background and literature search. Time: 3 to 4 weeks. 6/15 - 7/15
2. Develop experimental plan and purchase equipment. Time 4 to 5 weeks. 7/15 - 8/20
3. Perform studies and evaluate data. Time: 4 to 5 months. 8/20 - 1/20

B. Strategy: Use high pressure pH measurements and/or wet chemical methods to determine carbon dioxide absorbtivity in tobacco through solution chemistry.

1. Complete evaluation of high pressure pH probe. Time: 3 to 4 weeks. 6/15 - 7/15
2. Measure carbon dioxide uptake in tobacco extracts. Time: 4 to 6 weeks. 7/15 - 9/1
3. Extrapolate extract data to tobacco and determine applicableness to expansion. Time: 1 to 2 weeks. 9/1 - 9/20
4. Determine carbon dioxide dissolution kinetics. Time: 2 to 3 months. 9/20 - 12/20

C. Strategy: Use consultant to further understand clathrate formation and pursue research course based on his recommendation or contract for lab services. Time: 2 to 6 months. 6/15 - 12/15

II. Objective: Quantify sorption properties of the substrate at equilibrium.

A. Strategy: Use aqueous extracts of tobacco to study the absorbtion of impregnants as related to the NET or DIET processes.

1. Complete measuring the solubility of gas in these solutions. Time: 2 weeks. 7/20 - 8/10
2. Measure the decomposition temperature of the hydrates that may form in these solutions and estimate the amount of gas absorbed by the clathrates. Time: 2 weeks. 6/15 - 6/30

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B. Strategy: Use the isochoric cooling technique developed by Sloan et. al. to measure the amount of gas uptake into tobacco.

1. Complete quantifying the amount of CO2 uptake by bright tobacco as a function of pressure, OV, and casing relative to a reference temperature. Time: 4 weeks. 8/15 - 9/15

2. Determine the absolute amount of CO2 uptake at the above reference temperature and relate to previous measurements. Time: 2 weeks. 7/15 - 8/3

III. Objective: Quantify the sorption properties of the tobacco substrate under dynamic conditions.

Strategy: Use stability of the impregnant in the tobacco substrate over time as an indicator for dynamic changes.

1. Determine the amount of absorbed impregnant remaining in the substrate after venting, over time, as a function of impregnation temperature, pressure, and OV using CO2 or nitrogen. Time: 4 weeks. 7/30 - 8/30

2. Determine the applicability of using the above most promising impregnation conditions for expansion through pilot plant tests. Time: 4 weeks. 8/15 - 9/15

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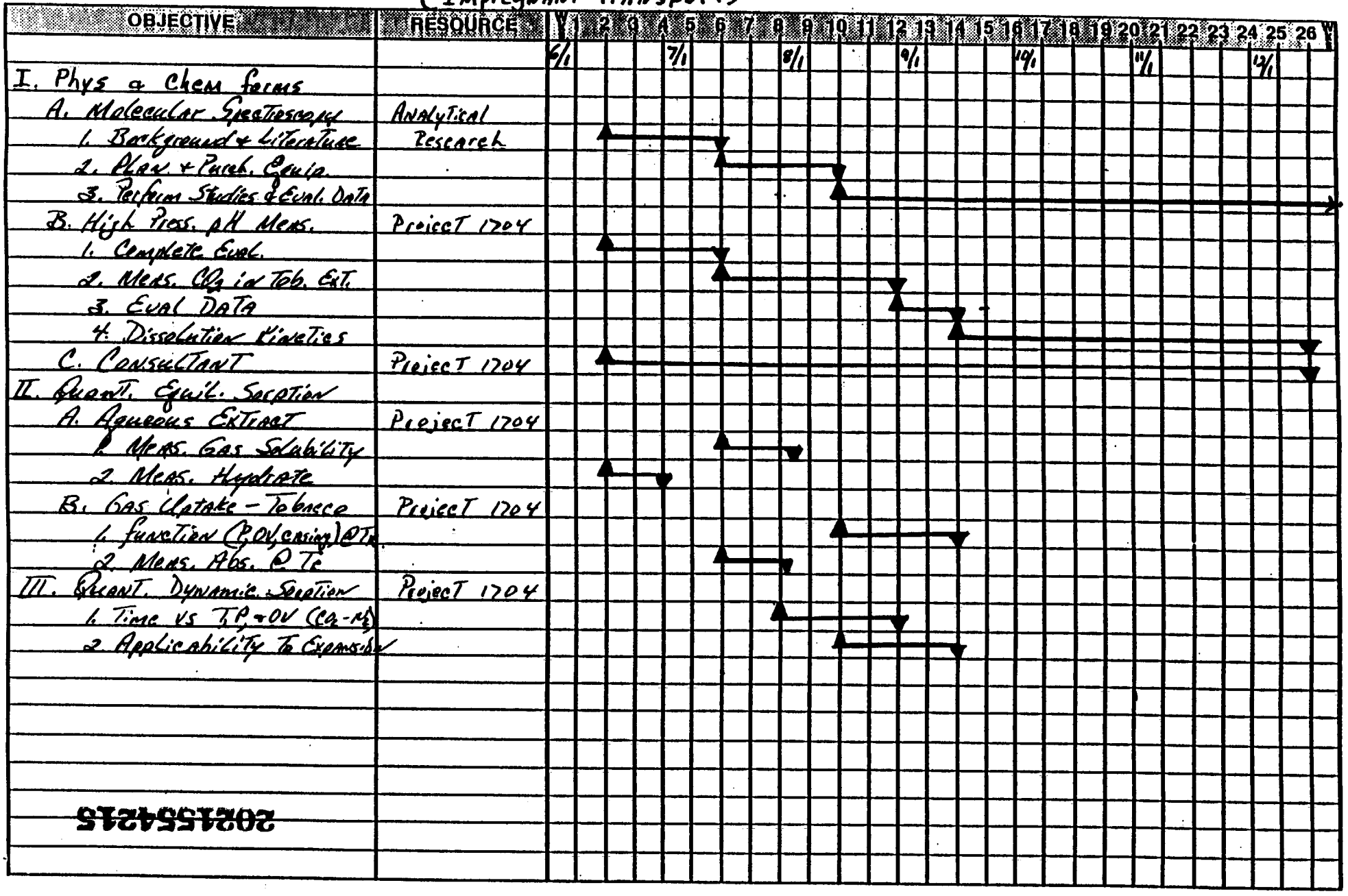
Mechanism Studies on Tobacco Expansion

(Impregnant Transport)



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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. C. L. Ellis Date: March 26, 1990

From: E. G. Craze, Jr.

Subject: 1990 Operational Plans

In reference to your request for operational plan updates, there are no significant changes to the original 1990 Operational Plans for the New Expanded Tobacco program.

cc: [redacted]Stewart/

2021554216

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. A. C. Lilly

Date: February 26, 1990

From: E. G. Craze, Jr.

Subject: 1990 Operational Plans

Attached is the 1990 Operational Plan for the New Expanded Tobacco program. The plan is divided into two major parts: 1) long-range development of a new expansion process to satisfy the requirements for future new products and 2) short-term development of the existing DIET process to enhance processing performance and product utilization. The current directly allocated personnel resources for the program are estimated to be 18.8 people and are expected to escalate to approximately 29.5 people by the end of 1990. The duration of the program is envisioned to continue into 1993.

The transfer of technology to PM USA Engineering for an improved DIET process is targeted in 1990 to impact on any future processing designs for added manufacturing capacity. The transfer of technical information for commercialization of a new expanded tobacco process is envisioned to be late in 1992. In addition, close coordination will exist with Engineering throughout the duration of the program.

Please advise if you have any questions or desire additional information concerning the attached operational plan for the New Expanded Tobacco program.

Ed Craze

Attachment

cc: H. G. Burnley, Jr.
J. L. Myracle
J. F. Whidby
W. D. Winterson

2021554217

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

NEW EXPANDED TOBACCO PROGRAM

Mission Statement

Develop tobacco expansion technology and associated processing for the production of expanded tobacco materials having the physical and subjective characteristics required to support future product needs. The processes will also be developed in accordance with sound environmental practices.

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

Background

Expanded tobacco (DIET) is a major component in PM cigarette blends. Its importance in the design of new cigarette products will continue to grow as tar and nicotine deliveries and burn rates are modified. Presently, there is an upper limit of expanded tobacco inclusion in our cigarette blends due to the subjective character of DIET processed tobacco. Therefore, it is critical that new expansion technology be developed to provide an expanded tobacco that meets the subjective and physical requirements for future cigarette products.

2021554219

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

Objectives

1. Develop a new tobacco expansion process which meets the subjective and physical requirements for future new products.

2. Modify the existing DIET process to improve processing performance and/or product quality for future product and manufacturing requirements.

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

Objective: Develop a new tobacco expansion process which meets the subjective and physical requirements for future new products.

Strategies

1. Establish a project team with appropriate skills and knowledge for all related project activities.

2. Define expanded tobacco product and processing targets for meeting program objectives.

3. Develop a fundamental understanding of the mechanisms associated with the expansion of tobacco.

4. Identify processing concepts for satisfying product quality and processing targets.

5. Assess feasibility of processing concepts and define pilot process(es).

6. Design and construct a pilot plant with flexibility to resolve design issues and to produce expanded tobacco for product development and evaluation.

7. Finalize process design specifications for transfer to PM USA Engineering.

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

Objective: Modify the existing DIET process to improve processing performance and/or product quality for future product and manufacturing requirements.

Strategies

1. Characterize the processing performance and product quality of the existing DIET process.

2. Identify hypotheses for improving the existing DIET processing performance and product quality.

3. Investigate processing concepts to meet program objectives.

4. Finalize DIET improvement design specifications for transfer to PM USA Engineering.

2021554222

Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

Objective: Develop a new tobacco expansion process which meets the subjective and physical requirements for future new products.

Strategies/Tactics

Strategy 1:		**Establish a project team with appropriate skills and knowledge for all related project activities.**	
Tactics:	1.1.	Select individuals with skills in process development, product development, physical research, and modeling to form the core of the project team.	1st Qtr '90
	1.2.	Identify coordinating individuals within PM USA Engineering and other departments.	Ongoing
Strategy 2:		**Define expanded tobacco product and processing targets for meeting program objectives.**	
Tactics:	2.1.	Review the current DIET processing and production situation.	1st Qtr '90
	2.2.	Identify the role of expanded tobacco in new products and establish future processing scenarios.	2nd Qtr '90
	2.3.	Define product quality and processing targets for new expanded tobacco process.	2nd Qtr '90 (Update as Needed)
Strategy 3:		**Develop a fundamental understanding of the mechanisms associated with the expansion of tobacco.**	
Tactics:	3.1.	Define existing DIET process unit operations and their functions, including impregnation, expansion, drying, setting against collapse, and reordering.	1st Qtr '90
	3.2.	Review relevant PM and outside literature.	Ongoing
	3.3.	Evaluate effects of stiffness on CV.	1st Qtr '90
	3.4.	Evaluate effects of process variables on expansion and subjectives using 8-inch pilot system.	2nd Qtr '90
	3.5.	Determine how physical and chemical properties of the impregnant relate to expansion, including hydrate formation and other interactions with the tobacco matrix.	2nd & 3rd Qtrs '90

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	3.6. Determine the relationship between particle temperature, OV, and resistance to CV loss upon reordering, including the glass transition temperature.	2nd & 3rd Qtrs '90
	3.7. Propose and test other hypotheses regarding the physical and chemical changes which take place during impregnation, expansion, drying, setting, and reordering.	Ongoing
Strategy 4.	**Identify processing concepts for satisfying product quality and processing targets.**	
Tactics:	4.1. Conduct bench top process development work to test continuous impregnation concepts, alternate expansion agents including gases, the effect of impregnator size, flavor add-back, and alternate expansion/drying/ setting techniques.	2nd & 3rd Qtrs '90
	4.2. Develop process simulations of the heat transfer, mass transfer, and flow regimes within the present process and processes under development.	Ongoing
	4.3. Investigate new concepts for meeting program targets and screen via bench top testing.	Ongoing
Strategy 5.	**Assess feasibility of processing concepts and define pilot process(es).**	
Tactics:	5.1. Conduct assessment of processing concepts' feasibility including economic and environmental issues.	3rd Qtr '90
	5.2. Evaluate promising concepts using equipment prototypes, including impact of process parameters on performance and full product/ process evaluation vs. program targets.	4th Qtr '90 & 1st Qtr '91
	5.3. Define a pilot processing system for satisfying program goals and objectives.	1st Qtr '91
	5.4. Conduct an overall technical feasibility review with PM USA Engineering.	1st Qtr '91
Strategy 6.	**Design and construct a pilot plant with flexibility to resolve design issues and to produce expanded tobacco for product development and evaluation.**	

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

Tactics:	6.1.	Design pilot process with flexibility to resolve outstanding technical issues.	1st Qtr '91
	6.2.	Construct new expanded tobacco process pilot plant, utilizing prototype equipment where appropriate.	2nd & 3rd Qtrs '91

Strategy 7. Finalize process design specifications for transfer to PM USA Engineering.

Tactics:	7.1.	Evaluate impact of processing parameters on processing performance and product quality.	4th Qtr '91 & 1st Qtr '92
	7.2.	Optimize the new expansion process and support product studies.	2nd & 3rd Qtrs '92
	7.3.	Finalize design specifications for transfer to PM USA Engineering.	4th Qtr '92

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Objective: Modify the existing DIET process to improve processing performance and/or product quality for future product and manufacturing requirements.

Strategies/Tactics

Strategy 1:		**Characterize the processing performance and product quality of the existing DIET process.**	
Tactics:	1.1.	Review literature, visit DIET plants and coordinate with PM USA Engineering to develop information on the status of the existing DIET manufacturing process.	1st Qtr '90
	1.2.	Investigate the effects of processing conditions on product quality and subjective character using the R&D 8-inch pilot system.	2nd Qtr '90
	1.3.	Evaluate the impact of each DIET unit operation on product quality and subjectives.	2nd Qtr '90
Strategy 2:		**Establish hypotheses for improving existing DIET processing performance and product quality to optimize the utilization of DIET product.**	
Tactics:	2.1.	Evaluate information and test results to identify areas for improving processing performance and product quality.	1st Qtr '90
	2.2.	Establish hypotheses for optimizing the utilization of DIET product.	2nd Qtr '90
Strategy 3:		**Investigate processing concepts to meet program objectives.**	
Tactics:	3.1.	Investigate DIET processing parameters and identify operating conditions for optimum processing throughput and product utilization.	Ongoing
	3.2.	Investigate the impact of product degradation in the existing DIET manufacturing process and, if justified, define and/or develop means for improving degradation.	2nd & 3rd Qtrs '90
	3.3.	Design, fabricate, and install a plug flow separator on the 8-inch tower to investigate the benefits of eliminating product recirculation that exists in the present tangential separator.	2nd Qtr '90

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	3.4. Evaluate the effect of plug flow separation on product quality, subjective character and tobacco throughput.	2nd & 3rd Qtrs '90
	3.5. If warranted, investigate means of achieving plug flow separation on a manufacturing scale.	3rd Qtr '90
	3.6. Define DIET processing improvements and incorporate them into the 8-inch pilot system for evaluation and development.	3rd Qtr '90
Strategy 4:	**Finalize DIET improvement design specifications for transfer to PM USA Engineering.**	
Tactics:	4.1. Test and evaluate the improved process to define processing performance, product quality, throughput and product utilization limits.	3rd & 4th Qtrs '90
	4.2. Develop scaleup information for an improved DIET manufacturing process.	4th Qtr '90
	4.3. Finalize engineering design specifications for the improved DIET process.	4th Qtr '90
	4.4. Transfer design package to PM USA Engineering.	4th Qtr '90

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NEW EXPANDED TOBACCO PROGRAM

Estimated Resource Requirements

Division	Current	12/90	1991	1992	1993	1994
Tobacco Fundamentals	7.5	9.0	9.0	6.0	4.0	--
Tobacco Materials	3.5	4.5	4.5	3.0	1.0	--
Analytical Research	0.3	1.0	1.0	1.0	0.5	--
Physical Research	4.0	6.5	6.5	2.0	--	--
Flavor Development	0.3	1.0	1.0	0.5	0.5	--
Cigarette Development	0.3	1.0	1.0	0.5	--	--
Cigarette Testing	0.5	2.0	2.0	1.0	0.5	--
Product Evaluation	0.3	0.5	0.5	0.5	0.5	--
Chemical Research	0.3	2.0	2.0	0.5	0.5	--
Development Engineering	1.5	1.5	1.5	1.0	0.5	--
Biochemical Research	0.3	0.5	0.5	0.2	--	--
Cigarette Technology	--	--	--	--	--	--
Total Directly Allocated Resources*	18.8	29.5	29.5	16.2	8.0	--

*Computer Applications, Administrative Services and Tobacco Processing and Fabrication are considered to be indirectly allocated resources.

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Cast Sheet RCB

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

CAST LEAF DEVELOPMENT
ABSTRACT

The objectives of this project are a)to develop a cast leaf product which can be engineered to meet the flexible future needs of PM USA and PM International, b)to use new technology to improve the quality and production rate of RCB from the BL Plant, and c)to develop engineering data for a CL process for PM worldwide use. Upgraded lab casting facilities have been completed and a CL pilot plant will be built by August 1991 to enable these goals to be achieved. Data was presented of development work done in Tabacalera's plant in Cadiz which indicated the probability of a high degree of success for this project.

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Hazel/F41

PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: C. Ellis

Date: March 29, 1990

From: R. Uhl

Subject: CAST SHEET DEVELOPMENT PROGRAM UPDATE

As per your request at the planning meeting, this is to confirm that there are no significant modifications/changes to the Cast Sheet Development Program.

R. L. Uhl

cc: H. Alonso
H. Burnley
C. Lilly
Central Files

2021554231

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CAST SHEET
DEVELOPMENT PROGRAM
1990

The Cast Sheet Development Program addresses the future needs for PM-USA reconstituted sheet materials from the standpoints of optimizing overall sheet product capacity, providing the ability to modify the production mix of sheet materials to meet changing cigarette product needs, and providing new sheet materials to support new cigarette product development.

The 1990 Five Year Leaf Plan projects that the demand for reconstituted sheet materials will start to exceed the combined 7 day/week Park 500 and BL Plant capacity in 1994. There are several approaches to addressing this shortfall. Moderate expenditures to upgrade chokepoints at the two facilities could possibly increase total sheet capacity by 10% and meet needs until 1999; increasing the capacity of existing plant beyond that level results in exponentially rising expenditures as major equipment items are replaced. A second option is to reconstitute at jobber facilities, e.g., Scweitzer/LTR; however, this makes control of quality difficult and jeopardizes the security of proprietary flavor systems. A least alternative is to build additional recon capacity of the existing types in the present blend proportions. None of these options provides true flexibility to change the sheet production mix as needed to respond to the changing demands created by new cigarette products. A proposed alternative is to build a new cast sheet facility in the US or Europe, capable of producing a sheet with a flavor that is either RCB-like or RL-like, as required to meet needs. The development of this technology would also provide the option of retrofitting the BL Plant with this flexible capability.

The required total mix of sheet materials is constantly changing as new cigarette products, with less traditional blend formulations, create a marketplace niche. The overall trend has been toward lighter cigarettes with "lighter" blends, delivering less tar and less ammonia, and with less of the "dark" subjective character typical of RCB. Consequently, there is a trend away from RCB and toward RL in new blends. Sheet capacity must be flexible enough to meet this changing need. The only remaining option is to limit sheet demand by increasing the blend content of direct inclusion stems (ES/IS), up to the point where sheet stem requirements are impacted.

A concerted program is required to develop the proprietary sheet technology necessary to meet the sheet material needs of PM corporate brands worldwide. A pending factor in this area is the possible onset of EEC import tariffs or restrictions in 1992. The installation of sheet capacity in PM-Europe would eliminate 32 million lbs/yr of RL plus 5 million lbs/yr of RCB exports, providing PM-USA with adequate sheet capacity for the foreseeable future.

A cast sheet process of the type proposed is well suited for international application. It provides the flexibility to meet diverse subjective needs, can be installed in smaller capacity increments, and is less capital intensive than current PM reconstitution processes. Development of a new cast sheet process would enable PM to offer licensees the capability to produce a high quality sheet suitable for use in their brands and, at PM's option (probably with added proprietary flavors), in PM corporate brands.

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A cast sheet using alternate binders, or using non-chemical means to release tobacco pectin, would have the positive benefit of reduced environmental impact as compared to either the RCB or RL processes. This could be a major factor in the future of PM-USA and in potential international sheetmaking locales where waste treatment may be cost prohibitive, technically unfeasible, or otherwise restricted

The Cast Sheet Development Program will identify alternate binders that are chemically acceptable, have good sheet forming qualities, and provide the desired subjective character. Non-chemical means of releasing the pectin in tobacco will also be investigated; sheets made in this manner may be supplemented with lesser quantities of alternate binders as necessary to achieve the desired sheet properties. The effect of individual types of sheet feedstocks and rearrangement of feedstocks among sheet products will be evaluated. The effect of of tobacco grind size and other process parameters will be determined; initial results indicate that a higher slurry solids content (giving reduced drying load and increased capacity) is possible with finer mesh size. Flavoring systems for the alternate binder sheets will also be developed.

The present sheet handcasting facilities will be upgraded to provide a more consistent product and to provide quantities sufficient for flavoring and subjective work in handmade cigarettes. A pilot scale facility is necessary to delineate the equipment and processing characteristics pertinent to the new sheet material, to provide quantities suitable for survivability testing and cigarette production in Semiworks, and to support meaningful cigarette product development using a new type of sheet material. A corollary benefit of the pilot plant will be the ability to provide specialized cast sheets for research work, e.g., LBA investigations, plus the ability to evaluate humectants, feedstocks (e.g., ART stems), etc., and optimize the current RCB process without impacting production. A pilot facility is under preliminary design in conjunction with PM Engineering, for commissioning in 1991.

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RECONSTITUTED CAST SHEET PROCESS DEVELOPMENT

OBJECTIVES

1. Develop a new reconstituted cast sheet product that will provide opportunities for full utilization of by-products across the PM USA product lines projected for the 1990's, in a cost effective manner.

2. Support special product development and research efforts requiring non-standard cast sheets.

3. Optimize the current RCB process for sheet physical properties, production capacity, and environmental goals.

4. Support international needs for reconstituted product development.

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

CAST SHEET PROCESS DEVELOPMENT RESOURCE ALLOCATION

DIVISION	YEAR				
	1990	1991	1992	1993	1994
Tobacco Materials	4.0	5.5	5.9	5.5	5.5
Analytical Research	1.3	1.6	1.2	1.1	1.1
Biochemical Research	0.1	0.3	0.1		0.1
Chemical Research	0.1	0.1	0.2	0.1	
Physical Research					
Development Engineering	0.5	0.5	0.2		
Tobacco Fundamentals					
Product Evaluation		0.1	0.1	0.2	0.1
Flavor Development	0.7	1.1	1.0	0.9	0.9
Cigarette Development	0.1	0.1	0.1	0.2	0.2
Cigarette Technology	0.3	0.5	0.4	0.3	0.3
Technology Assessment	0.3	0.3	0.1	0.1	0.1
TOTAL	7.4	10.1	9.3	8.4	8.3

NOTE: Computer Applications, Tobacco Processing & Fabrication, and Adminstrative Services are assumed to be indirectly allocated.

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

RECONSTITUTED CAST SHEET PROCESS DEVELOPMENT

OBJECTIVE	STRATEGY	TACTIC	TIME
1. Develop a new reconstituted cast sheet product that will provide opportunities for full utilization of by-products across the PM USA product lines projected for the 1990's, in a cost effective manner.	1.1 Establish reconstituted product type and capacity needs to meet five-year marketing and manufacturing plans.	1.1.1 Analyze current product mix and potential growth of "light blends" for new products to determine the sheet types, and amount of each, that will be required to meet worldwide PM needs for reconstituted products.	2nd QTR 199C (semiannual update)
	1.2 Design and construct an upgraded laboratory facility and a pilot plant capable of producing standard RCB product and new cast sheet products.	1.2.1 Design and install an upgraded cast handsheet facility.	2nd QTR 199C
		1.2.2 Work in conjunction with PM Engineering to design a flexible design pilot casting facility.	2nd QTR 199C
		1.2.3 Complete installation of the pilot plant.	3rd QTR 1991
		1.2.4 Commission pilot plant (start up and prove-in runs).	4th QTR 1991
	1.3 Develop a subjectively neutral cast sheet product in order to provide flexibility in meeting reconstituted products requirements for the PM USA product line.	1.3.1 Develop cast sheet without ammoniacal or specific strong flavor by utilizing new binder systems or using pressure/ temperature to effect pectin release. a. Laboratory b. Pilot Plant	 3rd QTR 199C 1st QTR 1992
		1.3.2 Develop cast sheet types with unique subjective characteristics to respond	Ongoing

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		to specific market needs by flavor addition.	
2. Support special product development and research efforts requiring non-standard cast sheets.	2.1 Develop and test special cast sheet products to support research programs such as burn rate control, humectant modifications, alternate preservatives, new flavor systems, and LBA research.	2.1.1 Quantify the effect of sheet burn rate on tar delivery.	3rd QTR 199C
		2.1.2 Determine the sheet properties that affect burn rate.	4th QTR 199C
		2.1.3 Identify suitable alternate binders giving lower tar delivery.	4th QTR 199C
		2.1.4 Demonstrate pilot cast sheet with reduced tar delivery (using alternate binders).	1st QTR 1992
		2.1.5 Provide sheet in support of research programs relating to humectants, flavor systems, preservatives, and LBA research (LTF, crossed solubles, additives, etc.)	Ongoing
3. Optimize the current RCB process for sheet physical properties, production capacity, and environmental goals.	3.1 Develop new technology to optimize the physical properties of the current RCB product, leading to improved design for future capacity increases.	3.1.1 Quantify the effect that finer grind size has on sheet formation and survivability, and alternately, on enabling attainment of higher casting solids and reduced drying loads.	4th QTR 1991
		3.1.2 Determine any benefits for belt release systems for RCB sheet.	1992
		3.1.3 Determine the relative efficiencies of refining before or after aging to improve sheet physical properties	1992

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		(maximize pectin release) and/or reduce aging time.	
	3.2 Reduce the environmental impact of the BL Plant by reduction of NH_3, DAP and NO_3 without reducing the quality of RCB product.	3.2.1 Quantify the subjective and physical properties of RCB with non-washed burley stems.	1992
		3.2.2 Quantify the subjective and physical properties of RCB without burley stems, and corresponding feedstock changes in RL.	1992
		3.2.3 Quantify the subjective and physical properties of RCB without any stems, and corresponding feedstock changes in RL.	1992
		3.2.4 Supplement DAP/NH_3 with alternate binders.	1992
		3.2.5 Determine if reduced particle size allows reduction of DAP/NH_3 (to reduce N and P effluent) while maintaining RCB physical and subjective properties.	1992
4. Support PM International needs for reconstituted product development.	4.1 Develop cast sheet products to meet specific product development and tobacco utilization needs of PM International.	4.1.1 Evaluate tobacco feedstocks from specific countries using selected binder systems to provide cast sheets with acceptable properties.	Ongoing
		4.1.2 Develop flavor systems for cast sheets for specific countries.	Ongoing
	4.2 Develop engineering design data for packaging of a low cost cast sheet process for worldwide application.	4.2.1 Work in conjunction with PM Engineering to provide a "package" scaleable design for International applications.	1992

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	4.2.2 Customize "package" for specific countries.	Ongoing
4.3 Provide process and product evaluation support necessary to implement the use of TSA cast sheet product in Spain.	4.3.1 Assist TSA in rectifying problems interfering with the production of an acceptable sheet product.	3rd QTR 199C
	4.3.2 Coordinate trials in Cadiz to qualify ASTA-I for use in the Spanish Marlboro.	4th QTR 199C
	4.3.3 Develop a non-ammoniacal binder that is subjectively and physically acceptable with TSA tobaccos.	3rd QTR 199C
	4.3.4 Coordinate trials in Spain using the above new binder formulation to produce ASTA-II and/or RECA-II sheet for further evaluation.	1st QTR 1991
	4.3.5 Assist TSA in identifying and correcting process and equipment problems precluding the attainment of designed sheet capacity.	Ongoing

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PLANNING MEETING - SEPTEMBER 17, 1990

PROJECT PACT

Three program objectives were discussed. The development of a unique perforated floor/carpet system combined with electrostatic precipitation and phosphoric acid carbon filtration of recycle air has enabled a ventilation system that should addresss smoking concerns in the Benedum Center Lounge to be sucessfully addressed. The design specifications have been submitted to the Pittsburgh architects and engineers. An evaluation of a Japan Air Curtain "Smoking Compartment" as a drop-in unit for applications such as airports revealed limited utility of the tested unit. Newer units, with different geometries, may have some utility and resolution of the level, if any, of future activity in this area will be resolved with Corporate Affairs. Testing of citric acid loaded paper revealed good efficiency for removal of ammonia and nicotine from environmental tobacco smoke (ETS) laden air, but insufficiency as a complete treatment system. Assessment of supplementary treatment media will be performed.

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: H. G. Burnley

Date: February 14, 1990

From: C. R. Hayward

Subject: PACT - PLANS 1990

Plans have been developed for 1990 to cover the development of technology to improve the quality of indoor air (Project PACT). Priorities for the project are as follows:

1. The Benedum Lounge - Since the design is underway.
2. Airport Lounges - Next priority indicated.
3. Restaurants, etc.
4. Aircraft

The summary of the PACT plans are as follows:

1. Benedum

   * Complete Treatment Process - Done
   * Define Room Ventilation Requirements - March
   * Review Benedum Design - End March

2. Airport Lounges

   * Test and Demonstrate Performance of the JAC "Tornex" Unit in R&D - May
   * Set Up "Tornex" Unit in Populated Area - June
   * Complete Development of Improved Treatments Process (Necessary to Minimize Space Requirements) - July
   * Test and Demonstrate Contained Lounge - October
   * Analyze and Develop Design Package - December

3. Restaurants, etc.

   * Review Information Developed for Airport Lounges for Applicability to Open Areas - December
   * Develop Plans as Required - January 1991

4. Aircraft

   * Review Arrangements for Accommodating Treatment Units - August
   * Develop Plans for Aircraft Testing - September

If additional details are required, please contact me.

cc: W. Apple
J. Lephardt
R. Tamol

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PLANS TO SUPPORT BENEDUM

- Develop Information for Through Floor Ventilation

    * Begin Modification of Benedum - February 15
    * Complete Modifications - February 21
    * Begin Upflow Testing -February 22
    * Complete Testing - March 2

- Complete Upflow Testing at Titus - February 24

    * Analyze Data - February 28

- Make Recommendation to Benedum for Room Ventilation - March 5

- Review Benedum Lounge Design - End of March

- Demonstrate Actual Benedum Design in Simulation Room

    * Design Room Modifications - March 12
    * Begin Modifications - March 15
    * Complete Modifications - March 22
    * Testing Complete - End of March

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AIRPORT PLANS

- JAC Tornex Unit

    * Unit Arrives - Mid-March (Clear Customs?)
    * Select a Site to Test - End of February
    * Modifications to Permit Installation of Unit - Early March
      (Headroom Limitations)
    * Set Up Unit - Complete End of March
    * Begin Testing - Early April
        - Unit as is
        - With Improved Charcoal Filter
        - With Table Grillwork
    * Complete Testing - May
    * Set up Demonstration - June

- Contained Airport Lounges - Process Development

    * Improve Treatment Process for Gas Phase Removal (Existing
      Process Requires Too Much Space).
        - Begin "Box" Fundamental Testing - Underway
            . First Pass Acid on Paper - Complete Mid-March
            . Additional Acids and Bases on Paper - Begin March
            . Optimize Charcoal - Begin June

    * Modify Simulation Room for in Room Treatment - (including
      Paper Filters and Improved Charcoal)
        - Begin - July
        - Complete - End July

- Contained Airport Lounges - Simulation Room

    * Start Testing with ESP/Improved Carbon - August
    * Complete Testing - September
    * Modify Room for Filtrona/Improved Carbon - September
    * Start Testing - September
    * Complete Testing - October
    * Analyze Results and Air Flow Implications - November
    * Develop Package for Requirements - December

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AIRCRAFT PLANS

- When Improved Process is Completed

    * Review Arrangements for Aircraft Accommodation of Treatment - Unit - August
    * Develop Plans for Aircraft Testing - September

RESTAURANTS, ETC., PLANS

- Review Information Developed for Contained Airport Lounges - December

- Develop Plans for Open Area Bars, etc. - January 1991

- Begin Open Area Type Simulation

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

Abstract

Ambrosia

Ambrosia consists of two parts: Ambrosia I which is the development of a Chelsea-type product (vanilla-like sidestream aroma) and Ambrosia II which is segmented into three cigarette types - low smoke, low odor and low smoke/low odor.

Sienna is the P.M. product to satisfy the objective for Ambrosia I. This product is currently in Ad Pack testing. Plans included specifications needed for transfer to manufacturing for National Introduction, current qualitative research being conducted and mention of a tentative test market during first quarter, 1991.

Ambrosia II was summarized through an overview of monadic POL testing with current research being pursued to evaluate aroma and mainstream taste. Current plans included additional filter and cigarette paper evaluations needed for first quarter monadic POL testing for product optimization. A factory trial for the product(s) is still to be decided.

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. A. C. Lilly **Date:** March 27, 1990

From: R. P. Heretick

Subject: **1ST QUARTER UPDATES, 1990 OPERATIONAL PLANS**

At the 1st Quarterly 1990 R&D Planning Meeting the following major programs were presented:

- o Domestic Product Support
- o International Product Support
- o Project Ambrosia

Each of these programs followed the documents supplied for the 1990 Operational Plans. Additional information was made available for the Planning Meeting which included market place updates and test market updates where appropriate for the individual development projects.

A specific exception was reported, however, in that our anticipated sales volume for Japan in 1990 will be 32 billion.

R. P. Heretick

RPH:da

cc: C. L. Ellis
J. L. Myracle

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PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. A. C. Lilly

Date: February 16,_1990

From: R. P. Heretick

Subject: **PROJECT AMBROSIA**

Objective: Develop new products which provide a socially acceptable benefit for the consumer. This program is directed toward improvements in the social acceptability of room aroma, ashtray aroma, and clothing aroma.

Strategies:

I. Develop new cigarette products which exhibit a distinctive sidestream aroma.

This development incorporates two product objectives which utilize the same tactics. These tactics involve the evaluation of commercially available aroma release materials and the development of new aroma release materials. Once acceptable materials are available they are incorporated into the cigarette design by coating the cigarette paper or in a reformulation of the cigarette sidestream adhesive.

- Develop an acceptable product to complete with Chelsea.

1st Quarter

- Develop cigarette prototypes which exhibit a range of distinctive sidestream aromas.

1st Quarter

- Continue the development and optimization of distinctive aroma systems based on initial consumer research with these distinctive products..

3rd Quarter

II. Develop new cigarette products which exhibit a neutral sidestream aroma and which also incorporate reduced sidestream visibility.

- Initial prototypes utilizing Aromatek 245

2nd Quarter

- Blend component sidestream aroma evaluation

2nd Quarter

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- Investigations by Analytical Research and Chemical Research designed to understand the aroma developed by cigarette sidestream smoke.

1990

- New prototype design will include information gained in previous evaluations.

    1. Selection of aroma release materials to achieve neutral sidestream aroma

    2. Blend development with information gained from the component evaluation

    3. Evaluation of prototype designs and blend development which will lead to the objective of reduced sidestream aroma with minimal effect on mainstream subjective response

2nd Quarter

III. Investigations in conjunction with Analytical Research and Chemical Research designed to better understand the aroma developed by cigarette sidestream smoke.

- Commercialization of CR2898

1st Quarter

- Evaluation of sidestream smoke of selected cigarettes which exhibit differences in aroma.

2nd - 3rd Quarter

- Continue the experimental design and evaluation

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Ashtray Odor

Objective: To eliminate or reduce ashtray odor

I. Identify and screen compounds for their potential utility in reducing, eliminating or improving ashtray odor.
Initial screening would consist of: 1) smelling the compound in the presence of cigarette butts by a few "expert noses" (e.g., C. Hayes, F. Gullotta, R. Southwick, etc.), and if desirable differences are observed, 2) placing the compound both individually and n combination with cigarette butts) on the odor profiling panel for evaluation.

1. Review the odor profiling data from all of the ashtray-related test samples that have been profiled to date (approximately 50) and determine if any are worthy of further evaluation. (Complete 1st Quarter)

2. Evaluate cigarette butt aroma in the presence of different concentrations of l-carvone. (Complete 1st Quarter)

3. Evaluate cigarette butt aroma in the presence of zinc ricinoleate. (Awaiting the arrival of the "pure" compound from T. Sanders. Once the compound is obtained, initial screening should be completed in two weeks with the odor profiling of the compound expected to be completed in a month).

4. Evaluate other mint-like compounds (e.g., menthone, d-menthol, methyl salicylate) for their ability to modify ashtray odor. (Complete 2nd Quarter)

II. Convene a panel to subjectively evaluate promising compounds. The panel will consist of approximately ten-twenty people and will be convened once an adequate number of compounds or concentrations of a compound have been screened. A paired comparison testing procedure will be employed to compare treated (cigarette butts in the presence of a compound) vs untreated (control) cigarette butts. Samples will be evaluated for butt odor, other odor, and degree of difference and preference using a 7-point scale. (Once convened, complete panel testing in one month. Continuation of panel possible as additional compounds are identified).

III. Explore the possibility of adding to cigarettes those compounds that appear to significantly modify ashtray odor.

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

Resource Allocations

The current and projected resource allocation is shown below:

Cigarette Development

Project Leader	0.5
Product Development Engineer	1.0

Flavor Development

Scientist	1.0
Chemical Research	1.5
Biochemical Research	.25

Other Resources Required

Analytical Research
Cigarette Technology
Semiworks
CTSD
PED

R. P. Heretick

RPH:da

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: A. C. Lilly Date: February 19, 1990

From: B. C. LaRoy

Subject: **Technology Assessment Strategies & Tactics for 1990**

OBJECTIVE OF TECHNOLOGY ASSESSMENT

Ensure that R&D maintains appropriate awareness, knowledge and expertise in strategic areas of science and technology which will be needed by Philip Morris USA in the future (5-15 years).

STRATEGIES & TACTICS

The strategies and tactics established in 1988 and outlined in last years plans[1] have been generally successful and, with a few changes, will be carried forward through 1990. Status was reviewed at the December, 1989 Planning Meeting[2]. The discussion below will be restricted to specific tactical objectives for 1990.

STRATEGY I:

Develop and maintain a current assessment of strategic science and technology needs.

Tactics:

1. With the Technology Assessment Working Committee, identify the current strategic technology needs of PM USA Operations. Continue to develop and establish procedures by which the Committee can support the investigation, development and implementation of these technologies.

2. With the R&D Strategic Planning Committee, develop and establish procedures for better identifying the Strategic Science and Technology Needs of the R&D Programs.

STRATEGY II.

Develop and maintain current technical awareness of the broad bases of science and technology which may supply the above needs.

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Source: https://www.industrydocuments.ucsf.edu/docs/jjhm0000

Tactics:

1. Maintain current contacts with universities (Carnegie Mellon, Colorado State, Georgia Tech., N.Y. Polytechnic, Notre Dame, Seton Hall, University of Virginia, Virginia Commonwealth University, and Virginia Tech.) and companies (Stackpole, Stone, Coors, Sepracor, Pinnacle Research, and Motorola).

2. Establish new university and/or industrial contacts as appropriate. In particular, we will seek to expand our contacts in the areas of (1) catalysis, (2) adhesive mechanisms and (3) energy storage.

3. Determine the feasibility/advisability of establishing interactions with leading government supported laboratories (Sandia, Los Alamos). Establish such relationships if appropriate.

4. Establish procedures for working more effectively with R&D senior staff in investigating and developing new science and technology areas.

5. Support and maintain the Visiting Scientist Program to select and bring to PM R&D leading technologists whose work may be of value. Encourage and promote the exposure of the technical staff to these individuals.

STRATEGY III.

Coordinate and/or support the "acquisition" of appropriate expertise in science and technology areas of potential importance to the Company.

Tactics:

Strategic areas of science and technology to be developed in-house and/or through external contracts include:

1. New technologies for the production of specialized papers in support of R&D programs. Strategic needs include novel inorganic fillers and specialized adhesives. These developments will involve continued sponsored research at Virginia Tech., the University of Maine and Western Michigan University. (See plans for the Paper Program.)

2. Enhanced understanding of tobacco expansion mechanisms, leading to expanded fillers with improved physical and subjective properties. Strategic needs include means for continuous impregnation and total blend expansion as well as improved fundamental understanding of thermal ("glass transition") behavior. External research programs may be needed. (See plans for the New Expanded Tobacco program.)

3. Technologies for high speed optical inspection of cigarettes and/or novel products.

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4. Fundamental approaches to the high speed characterization of disordered systems (tobacco streams.) Contract research at Carnegie Mellon (Dr. Casasent) is anticipated.

5. New technologies for energy production and storage. Development work is in progress at N.Y. Polytechnic University and Pinnacle Research Institute. A collaborative program with Motorola is anticipated.

6. Better understanding of aerosol formation and aerosol properties. Dr. Schug (Va. Tech.) is continuing fundamental studies of liquid systems. Continued work with Dr. Bernstein (Colorado State) is aimed at basic understanding of the initial condensation of supersaturated systems and at experimental determinations of the effects of salt nuclei.

7. Development and application of knowledge-based "expert systems." Ongoing work in the Computer Applications Division[3] includes development of a cigarette design expert system to determine recommended cigarette parameters to meet specified performance goals as well as continuing explorations in the areas of process control, data interpretation, diagnosis, natural language interfaces, machine learning and inductive reasoning.

8. Development of neural computers for mapping and classification applications. Implementations planned by the Computer Applications Division[3] include predictors of subjective response from analytical data and of smoking preference from demographic data as well as the classification of electrophysiologial waveforms.

9. Improved understanding of low temperature catalysts for application to smoking products and/or room air purification. Collaboration will continue with Dr. Augustine (Seton Hall University). Contacts will be made with additional university or industrial laboratories that appear to be making significant contributions in this very complex area.

10. Improved separations technology. Efforts will be continued to identify emerging technologies with potential for nicotine or flavor separations.

11. Biodegradable materials. Initial contacts (Battelle) have been made regarding a potentially biodegradable polymer for use in paper or filters. Investigations in this area will be continued as appropriate.

12. Means of environmental smoke abatement. Effort will be continued to identify more effective means of particulate and/or vapor reduction phase ETS in ambient air.

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RESOURCES:

Personnel:

Current Technology Assessment Group personnel are Cliff Lilly, Bernie LaRoy, John Lephardt (on loan from Analytical Research), Henry Merritt, Ted Sanders, and Hazel Stewart (Secretary.)

Dr. Lephardt is currently devoting full time to the PACT program and Dr. Sanders is serving as coordinator of the Paper Program. Mr. Merritt is devoting the bulk of his time to the New Expanded Tobacco Program and to the research program with N.Y. Polytechnic. The addition of a new member (with business and technical degrees) is anticipated in 1990.

References:

1. B. C. LaRoy, "Technology Assessment Status and 1989 Strategies," Memo to A. C. Lilly, February 15, 1989

2. B. C. LaRoy, "Summary of Technology Assessment Discussion at the December, 1989 R&D Planning Meeting," January 1990

3. J. J. Blankenship, "Operational Plan - Application of Expert System and Neural Network Technologies," Memo to A. C. Lilly, February 13, 1990

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Web Filter
Development

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RECEIVED
APR 1 1990
CLIFF LILLY

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Distribution

Date: April 12, 1990

From: K. A. Newman

Subject: Operational Plan - Web Filter Development Program

Attached for your information is the Operational Plan for the Web Filter Development Program.

Distribution: Mr. H. Alonso
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OPERATIONAL PLAN

PROJECT NAME: WEB FILTRATION DEVELOPMENT

PROJECT COORDINATOR: K. A. NEWMAN

PROJECT OBJECTIVE: DEVELOP A PROPRIETARY SHEET-LIKE (WEB) FILTRATION SUBSTRATE HAVING PARTICULATE REMOVAL CAPABILITIES SIGNIFICANTLY GREATER THAN CELLULOSE ACETATE TOW WITH ACCEPTABLE SUBJECTIVE QUALITY

STRATEGY A: PRODUCE A WET LAID SHEET-LIKE STRUCTURE OF CELLULOSE ACETATE STAPLE AND CELLULOSIC FIBERS USING NON-WOVEN TECHNOLOGY

BENCHMARKS / RESPONSIBILITIES / TARGET DATES:

1) PRODUCE HAND SHEETS WITH VARIOUS CA/CELLULOSE FIBER COMBINATIONS AND EVALUATE FORMATION AND PHYSICAL PROPERTIES (B. ROGERS, N. GAUTAM) COMPLETE

2) INVESTIGATE CREPING OF CA/CELLULOSE WEB AT UNIVERSITY OF MAINE (N. GAUTAM, B. ROGERS, D. LEISTER) 2Q90

3) A) PRODUCE CONTINUOUS WEB AT UNIVERSITY OF MAINE WITH VARIOUS RECIPES TO ACHIEVE OPTIMAL WEB QUALITY (B. ROGERS, N. GAUTAM) 2Q90
B) PRODUCE CONTINUOUS WEB AT VENDOR LOCATIONS (KIMBERLY-CLARK, JAMES RIVER) (B. ROGERS, N. GAUTAM) 3Q90

4) MEASURE WEB PROPERTIES, PRODUCE FILTER RODS FROM CA/CELLULOSE WEBS, EVALUATE WEB MACHINABILITY AND MEASURE FILTER ROD PROPERTIES (K. NEWMAN, D. LASLIE) 2Q90

5) SELECT WEB FILTER MODELS, DESIGN AND PRODUCE MACHINE MADE CIGARETTES, MEASURE DELIVERIES, COORDINATE SUBJECTIVE EVALUATION OF WEB FILTERS AT EQUAL DELIVERIES AGAINST CELLULOSE ACETATE TOW, CELLULOSE WEB AND CELLULOSE ACETATE WEB CONTROL MODELS (K. NEWMAN) 2Q90

6) EVALUATE PHYSICAL PROPERTIES OF HAND SHEETS WITH VARIOUS TYPES OF FIBERS, LEVELS OF CA STAPLE, BINDERS, ADDITIVES - SELECT CANDIDATES FOR SUBJECTIVE EVALUATION IN HAND MADE FILTERS AND CIGARETTES (N. GAUTAM, D. LEISTER, K. NEWMAN) 3Q90

7) EVALUATE WEB FILTERS PRODUCED FROM TOBACCO MATERIALS - COORDINATE WITH FTR (B. ROGERS, K. NEWMAN, R. SLAGLE) 3Q90

8) EVALUATE COMMERCIALLY PRODUCED WEBS (B. ROGERS, N. GAUTAM, D. LASLIE, K. NEWMAN) 3Q90

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STRATEGY B: APPLY COATINGS OF CELLULOSE ACETATE AND/OR TRIACETIN TO CELLULOSE WEB

BENCHMARKS / RESPONSIBILITIES / TARGET DATES:

1) PRODUCE WEB SAMPLES WITH CELLULOSE ACETATE AND/OR TRIACETIN COATED ONTO CELLULOSE WEB AT LEVELS UP TO 10 % FROM ACETONE SOLUTIONS OF VARIOUS SOLIDS CONCENTRATIONS (D. SIMPSON, B. ROGERS, K. NEWMAN) **COMPLETE**

2) MEASURE WEB PROPERTIES, PRODUCE FILTER RODS FROM COATED WEBS, EVALUATE WEB MACHINABILITY AND MEASURE FILTER ROD PROPERTIES (D. LASLIE, K. NEWMAN) **COMPLETE**

3) PRODUCE WEB ROLLS AT JAMES RIVER CORP. WITH 25 % CELLULOSE ACETATE COATING ADD-ON AND 25 % CELLULOSE ACETATE + TRIACETIN COATING ADD-ON (D. SIMPSON, B. ROGERS, K. NEWMAN) **2Q90**

4) SELECT COATED WEB FILTER MODELS, DESIGN AND PRODUCE MACHINE MADE CIGARETTES, MEASURE DELIVERIES, COORDINATE SUBJECTIVE EVALUATION OF COATED WEB FILTERS AT EQUAL DELIVERIES AGAINST CELLULOSE ACETATE TOW, CELLULOSE WEB AND CELLULOSE ACETATE WEB CONTROL MODELS (K. NEWMAN, B. DWYER) **2Q90**

5) DETERMINE LOCATION FOR COMMERCIAL SCALE WEB COATING - PRODUCE WEB, FILTER RODS AND CIGARETTES FOR LARGER SCALE EVALUATION (B. ROGERS, D. SIMPSON, K. NEWMAN) **4Q90**

STRATEGY C: ACETYLATE CELLULOSE FIBERS TO OBTAIN THE SUBJECTIVE CHARACTER OF CELLULOSE ACETATE

BENCHMARKS / RESPONSIBILITIES / TARGET DATES:

1) DETERMINE THE FEASIBILITY OF DIRECTLY ACETYLATING CELLULOSE WEB USING ACETIC ANHYDRIDE ACETYLATING AGENT AND POTASSIUM ACETATE CATALYST (D. SIMPSON) **COMPLETE**

2) PRODUCE FILTER RODS FROM ACETYLATED WEB AND MEASURE FILTER ROD PROPERTIES; DESIGN AND PRODUCE HAND-MADE CIGARETTES AT EQUAL DELIVERIES FOR ANALYTICAL AND SUBJECTIVE EVALUATION (D. SIMPSON, K. NEWMAN, D. LASLIE) **COMPLETE**

3) OPTIMIZE THE TECHNIQUE AND MATERIALS FOR ACETYLATION OF CELLULOSE WEB AND/OR PULP (D. SIMPSON) **3Q90**

4) PRODUCE HAND SHEETS WITH ACETYLATED PULP AND EVALUATE SUBJECTIVE QUALITIES USING HAND MADE FILTERS ON DELIVERY MATCHED CIGARETTES (B. ROGERS, N. GAUTAM, D. LASLIE, K. NEWMAN) **2Q90**

5) ESTABLISH SITE FOR COMMERCIAL SCALE SAMPLE PRODUCTION OF ACETYLATED WEB AND/OR PULP (D. SIMPSON, K. NEWMAN) **4Q90**

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STRATEGY D: APPLY ADDITIVES TO ALTER/ENHANCE THE SUBJECTIVE CHARACTERISTICS OF CELLULOSE WEB

BENCHMARKS / RESPONSIBILITIES / TARGET DATES:

1) EVALUATE ADDITIVES TO IMPROVE FILTRATION CHARACTERISTICS AND SUBJECTIVE QUALITY OF CELLULOSE WEB FILTERS; PRODUCE FILTER RODS AND CIGARETTE MODELS IN MONO AND DUAL CONFIGURATIONS AT VARIOUS DELIVERY LEVELS - ANALYTICALLY AND SUBJECTIVELY EVALUATE (G. KERITSIS, D. LASLIE, M. WHITE) 2Q90

2) EVALUATE TOBACCO SOLUBLES ON VARIOUS WEB TYPES (G. KERITSIS, R. SLAGLE) 3Q90

3) EVALUATE IMPROVED METHODS FOR THE APPLICATION OF ADDITIVE MATERIALS ONTO WEBS - EITHER DURING FILTER MAKING OR DURING WEB PRODUCTION (G. KERITSIS, D. LASLIE) 3Q90

STRATEGY E: EVALUATE DRY-FORMED FILTRATION SUBSTRATES

BENCHMARKS / RESPONSIBILITIES / TARGET DATES:

1) INVESTIGATE DRY-FORMED MATERIALS SUITABLE FOR SMOKE FILTRATION APPLICATIONS (G. KERITSIS, K. NEWMAN) 2Q90

2) DETERMINE REQUIREMENTS FOR MACHINE MAKING FILTER RODS WITH DRY-FORMED MATERIALS; PRODUCE FILTERS AND CIGARETTES FOR ANALYTICAL AND SUBJECTIVE EVALUATION (D. LASLIE, K. NEWMAN) 2Q90

3) EVALUATE WETTABILITY OF "HIGH-BULK" POLYPROPYLENE WEB; PRODUCE FILTERS AND CIGARETTES FOR ANALYTICAL AND SUBJECTIVE EVALUATION (G. KERITSIS, K. NEWMAN) 3Q90

STRATEGY F: OPTIMIZE THE MATERIAL PREPARATION AND FILTER-MAKING PROCESS FOR WEB MATERIALS

BENCHMARKS / RESPONSIBILITIES / TARGET DATES:

1) OBTAIN WEB CORRUGATION / ROD MAKING EQUIPMENT AND MAKE OPERATIONAL (D. LASLIE) COMPLETE

2) CONDUCT CHARACTERIZATION STUDIES ON CELLULOSE WEB - DEVELOP UNDERSTANDING OF BASIC WEB FILTER MAKING TECHNIQUES (D. LASLIE) COMPLETE

3) PRODUCE FILTERS WITH EXPERIMENTAL WEBS; EVALUATE WEB MATERIAL QUALITIES BEFORE AND AFTER CORRUGATION (D. LASLIE, K. NEWMAN) ON-GOING

4) MODIFY THE EXISTING CORRUGATOR/ROD MAKER AS REQUIRED TO IMPROVE THE RUNNABILITY OF THE EXPERIMENTAL WEBS (D. LASLIE) ON-GOING

5) EVALUATE EMBOSSING PATTERNS FOR IMPROVEMENT OF FILTER RTD VARIABILITY AND END APPEARANCE (R. NEWSOME, D. LASLIE) 3Q90

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6) INVESTIGATE TECHNOLOGIES AND OPERATING METHODOLOGIES FOR CORRUGATION AND/OR WEB FILTER MAKING AT OTHER LOCATIONS FOR APPLICATION TO WEB DEVELOPMENT PROGRAM - e.g. CELANESE SYSTEM, INTERTABA, CORRUGATED BOX PRODUCER, OIL FILTER PRODUCER (D. LASLIE, K. NEWMAN) 2Q90

STRATEGY G: SUPPORT PRODUCT DEVELOPMENT IN THE APPLICATION OF NEW WEB FILTER TECHNOLOGY

BENCHMARKS / RESPONSIBILITIES / TARGET DATES:

1) DETERMINE RELATIONSHIPS BETWEEN PHYSICAL WEB PARAMETERS, FILTER MAKING PERFORMANCE AND FILTRATION PROPERTIES (D. LASLIE, K. NEWMAN, B. DWYER, D. LEISTER) 4Q90

2) APPLY NOVEL WEB CONCEPTS TO BEST OF THE LOWEST AND LOW TAR / HIGH FLAVOR PROGRAMS; ANALYTICALLY AND SUBJECTIVELY EVALUATE CIGARETTES (M. WHITE, K. NEWMAN) ON-GOING

3) EVALUATE NOVEL WEB FILTERS ON MENTHOLATED AND CARBON PRODUCTS (D. LASLIE, M. WHITE, A. FINLEY, K. NEWMAN) 3Q90

4) EVALUATE NOVEL WEB FILTERS IN CONCENTRIC CONFIGURATIONS (M. WHITE, K. NEWMAN) 4Q90

5) INCLUDE NEW WEB FILTER DESIGN CRITERIA INTO CIGARETTE DESIGN MODEL (B. DWYER) 4Q90

6) SELECT BEST WEB CANDIDATES FROM SUBJECTIVE EVALUATIONS AND SELECT DESIRED PRODUCT FOR LARGER SCALE EVALUATION (P. GAUVIN, D. HERETICK, H. SPIELBERG) 4Q90

PROJECTED RESOURCE ALLOCATION

SUPPORT AREA	MAN-YEARS	
CIGARETTE TECHNOLOGY	2.5	
PHYSICAL RESEARCH	2.0	
PAPER PROCESSING DEVELOPMENT	1.5	
CIGARETTE TESTING	0.5	
FLAVOR DEVELOPMENT	0.5	
TOBACCO PROCESSING & FABRICATION	0.5	
PRODUCT DEVELOPMENT	0.4	
CHEMICAL RESEARCH	0.2	
ANALYTICAL RESEARCH	0.1	
PRODUCT EVALUATION	0.1	
TECHNOLOGY ASSESSMENT	0.1	
SUB-TOTAL		8.4
JAMES RIVER CORPORATION	0.5	
KIMBERLY-CLARK CORPORATION	0.5	
UNIVERSITY OF MAINE	0.1	
WEB DYNAMICS CORPORATION	0.1	
SUB-TOTAL		1.2
TOTAL		9.6

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TECHNOLOGY TRANSFER

RECIPIENT	TECHNOLOGY	DATE
PRODUCT DEVELOPMENT	NOVEL WEB FILTER SYSTEM	4Q90 - 1Q91
	ENHANCED CIGARETTE DESIGN MODEL	4Q90
PM INT'L	NOVEL WEB FILTER SYSTEM	1Q91
	ENHANCED CIGARETTE DESIGN MODEL	1Q91
	IMPROVED WEB FILTER MAKING PROCESS	1Q91
ENGINEERING	IMPROVED WEB FILTER MAKING PROCESS	4Q90

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Minutes

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Notes

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